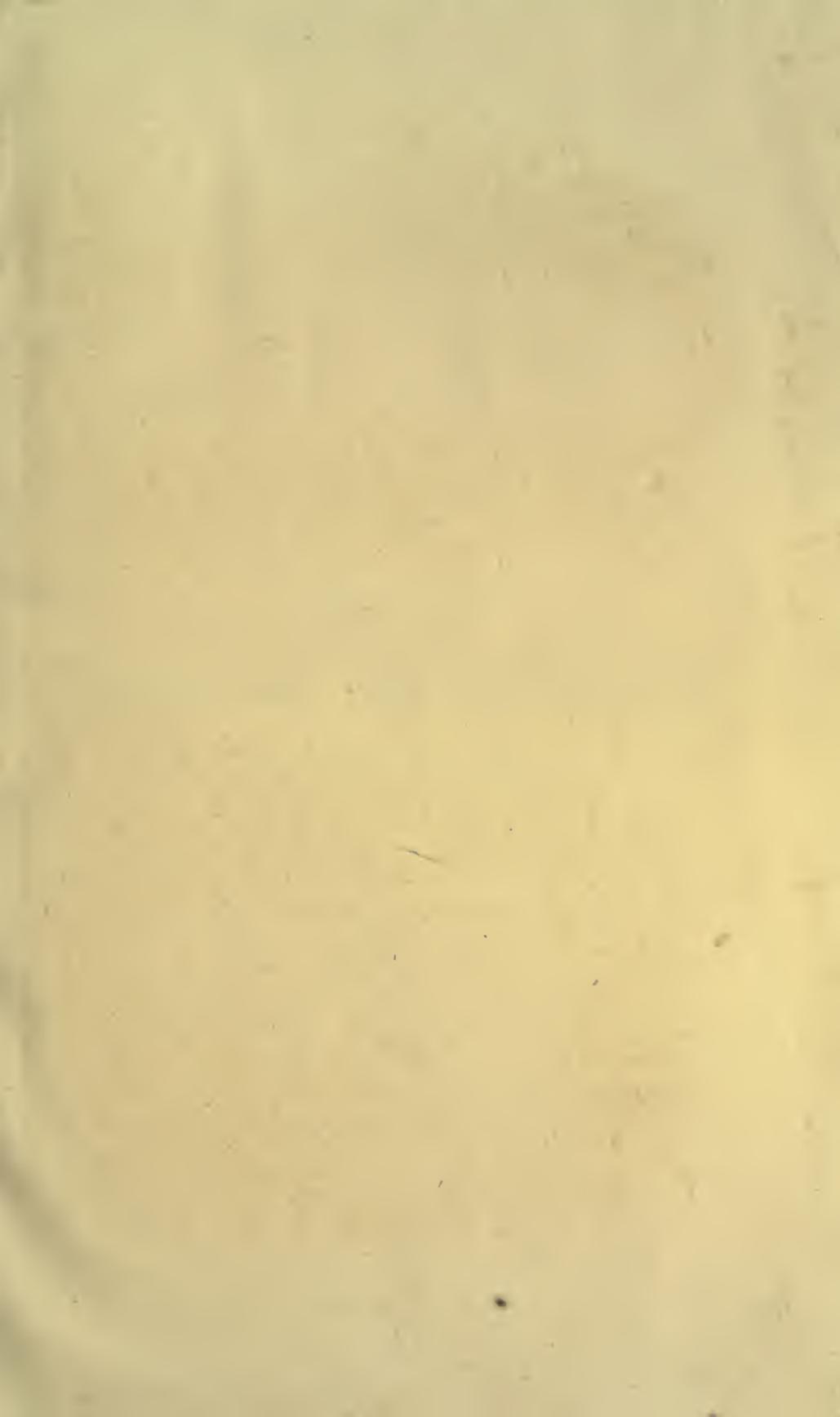




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PRACTICAL
LITHOTOMY AND LITHOTRITY.

BY THE SAME AUTHOR.

THE PATHOLOGY AND TREATMENT OF STRICTURE
OF THE URETHRA, AND URINARY FISTULÆ.

The JACKSONIAN PRIZE ESSAY for 1852.

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PRACTICAL *March 1867*

LITHOTOMY AND LITHOTRITY;

OR,

AN INQUIRY INTO THE BEST MODES

OF

REMOVING STONE FROM THE BLADDER.

BY

HENRY THOMPSON, F.R.C.S.,

SURGEON EXTRAORDINARY TO H.M. THE KING OF THE BELGIANS;
SURGEON TO UNIVERSITY COLLEGE HOSPITAL; CONSULTING SURGEON TO THE ST. MARYLEBONE
INFIRMARY; FELLOW OF UNIVERSITY COLLEGE; HONORARY CORRESPONDING
MEMBER OF THE SOCIÉTÉ DE CHIRURGIE OF PARIS, ETC., ETC.



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TO STUDENTS IN MEDICINE,
ESPECIALLY TO THOSE, BOTH PAST AND PRESENT, OF
UNIVERSITY COLLEGE HOSPITAL,
WITH WHOM, AS COMPANIONS AND FELLOW-WORKERS, I HAVE SPENT
SOME OF THE MOST PLEASANT HOURS OF MY LIFE,

This Work is Inscribed,

BY

THE AUTHOR.

P R E F A C E.

THE larger portion of the matter contained in the following pages was prepared for the Lettsomian Surgical Lectures of the Medical Society of London for the past year. The limits prescribed, however, permitted me to select for delivery only a portion of the matter prepared. I have, therefore, determined on publishing the whole in its original form, believing that in this way only could I hope to do anything like justice to the subject itself, or to the views which are put forth in relation to it.

I may premise that it is no part of my design to present a history of the means employed during the last 2000 years to remove stone from the human bladder. Neither is any portion devoted to discussions respecting the chemical and physical constitution of calculi, the causes of calculous formation, or the symptoms which the presence of stone in the bladder gives rise to; these subjects having, with the exception of causation, been fully and successfully examined.

The sole object of this work is to present a consideration of the best operative procedures now in use for the removal of stone from the bladder of the male patient. These will be described, with a view not only of enforcing those broad principles which are pretty generally, though, perhaps, not

always sufficiently, recognized, as necessary to guide the surgical student, but of furnishing many useful practical details, which a considerable experience and careful observation of varied schools alone can supply.

An exposition of these, it is believed, may prove not without value in relation to Lithotomy, and to some debated questions in connection with it; while some important considerations, bearing on the operation of Lithotrity, will, it is believed, be discussed here for the first time. Lastly, the various modes of operating will be compared, and their merits discussed, with a view to determine the relative scope and applicability of each to the numerous and varied exigencies which are presented by calculous patients. The principles so deduced will be exemplified in practice by the recital of cases from my own experience selected for illustration.

And here I must be permitted to acknowledge the very many obligations which I have incurred, and the unusually valuable sources of information which have been kindly placed at my disposal during the prosecution of my task.

I am indebted to many of the best known hospital surgeons of this country for very complete and valuable information relating to nearly 1500 cases, the value of which I can scarcely over-estimate, affording me a total of authentic reports from all sources respecting more than 2300 cases, of which 1800 are available for statistical purposes. (See pp. 223-30.)

I have been entrusted by the son of the late Mr. Crichton, of Dundee, one of the most experienced and successful lithotomists in Great Britain, with the entire and unpublished notes of his practice. He cut, by the lateral

method, during a career of about sixty years, upwards of 200 cases, and of most of them made valuable observations on the spot, and sometimes in considerable length and detail. These will be frequently referred to.

From Dr. Keith, of Aberdeen, whom I regard as possessing as large an experience as any man living in this country, since he has operated on more than 300 cases, I have received most important aid. For his extreme kindness in freely placing at my disposal the history of each one of these cases, and all the leading particulars respecting it, noted while the patient was under his care, my most grateful acknowledgments are due.

In Lithotrity, the unrivalled experience of Civiale, its renowned inventor and perfector, has been unreservedly communicated to me on all occasions; and he has been especially desirous to afford me all the aid in his power in connection with my present task. I gladly seize the present opportunity of acknowledging to him my great and numerous obligations.

It has been my aim to embody in these pages as much as possible of the fruits of these experiences, added to that which I have myself personally enjoyed. The aim and scope of every portion of the work, as regards both its plan and execution, although I am very conscious of numerous shortcomings, will be to carry forward, from the outset of the first chapter to the final propositions of the last, a series of logical deductions from sound experience in relation to practice, and thus to verify the title which I have selected, viz. PRACTICAL LITHOTOMY and LITHOTRITY.

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LITHOTOMY.

CHAPTER I.

LITHOTOMY : GENERAL CONSIDERATIONS RESPECTING IT.

Lithotomy: various Modes of performing now employed.—Necessity for Variety.—Perineal Lithotomy may be lateral or central.—Description of Perineum.—Outlet of the Male Pelvis.—Its Boundaries and Measurements.—Dissection of Perineum from Skin to Neck of the Bladder.—The Parts cut in Lithotomy.—The Parts to be avoided.

THE various operations which are employed for the Removal of Stone from the Bladder of the male subject may be arranged under two heads ; viz :—

1. Those by which the stone is removed through an opening artificially made by the surgeon, either into the urethra or bladder ; and comprehended under the term LITHOTOMY.

2. Those by which the stone is crushed in the bladder, and removed through the natural passage or urethra, without cutting ; the process being in all cases sufficiently indicated by the general term LITHOTRITY.

I shall enter first upon the consideration of Lithotomy, as being the older operation, the most extensively known, and that which is generally best understood. It is to be regarded also as, perhaps, the most widely applicable opera-

tion, if all the cases of stone, in children and adults, are considered indiscriminately; although it is certainly not to be so regarded if adult cases are considered separately. These questions, however, will be discussed at length in the proper place. Moreover, Lithotrity is better understood after the anatomical and surgical details of Lithotomy have become familiar to the mind, than when the converse order is pursued. Indeed, on many grounds it is advantageous to the student, in relation to both Lithotomy and Lithotrity, to make the study of the former precede that of the latter.

The subject of Lithotomy is by no means so simple and so limited at the present day, as it was considered to be a few years ago. If we take the writings of our best surgeons of the last fifty or sixty years, who have devoted themselves to it, we cannot but be struck with the fact that no other mode of performing Lithotomy is described or alluded to, except for occasional trial, or as a matter for speculative remark, than the Lateral Operation. Most assert that it is the only method which should be employed, except in certain circumstances, which are extremely unusual, and it is right to add that some great authorities appear still to hold the same opinion. The last ten or fifteen years, however, have witnessed some change in this respect in Great Britain, and several attempts have been made to remove the stone by other modes of incision; while the surgical practice of Paris has exhibited similar endeavours for a longer period of time. The introduction and progress of Lithotrity have in a great measure been the cause of this. Lithotrity has achieved such indisputable success with small stones, that those whose habits and inclinations lead them to prefer the use of the knife, have

endeavoured to find a method of employing it which should enable them to compete on equal terms with the crushing operation. But where no such feelings exist, the conviction has forced itself on the minds of most surgeons that the difference between a large stone and a small one is so great, both as regards the prognosis of the case and the difficulty to the operator, that it is impossible to regard even all calculous patients, who are to be submitted to the knife, as belonging to one category and as amenable but to one mode of the remedy. It is believed to be neither philosophical nor politic to apply to every stone, whether it be no bigger than a nut or as large as an apple, invariably one and the same proceeding. We have learned the importance, in the first place, of ascertaining, before deciding on any operation, the physical character of the stone ; that is, as regards its size and hardness ; and secondly, the condition of the patient in relation to the state of his urinary organs and his general susceptibilities. Hence the student of our subject in these modern times has several modes of Lithotomy to understand, and several questions presented to his consideration, in order that he may arrive at a practical solution of the question when any individual patient comes before him, viz. What is the best operation for this particular case ?

Hence, also, it is that, up to the present time, there has been little attempt to offer a comprehensive appreciation of the various methods now in vogue. The choice has hitherto been mainly limited to the alternatives of Lateral Lithotomy and Lithotrity, with recently, in some quarters, the added resources of the Median Operation. An attempt to supply this desideratum will occupy the latter portion of this work.

The various procedures employed under the name of Lithotomy must be arranged in two separate classes, viz. :—

First. Operations by which the bladder is reached from the perineum ; and among these I shall notice six principal methods, which will sufficiently include all minor modifications.

Secondly. An operation performed above the pubes, and known as the High or Suprapubic Operation.

First. Operations performed in the perineum, or Perineal Lithotomy.

These are of various kinds, but all may be classified either as Lateral or as Central Operations.

Lateral Operations are those which are confined within one of the lateral divisions of the perineum. The incisions are directed between the central and lateral muscles of that region. They necessarily approach the pubic ramus, the pudic artery and its branches, and are directed transversely to these latter, near to their origin from the arterial trunks. They involve one side of the prostate gland, it may be nearly to its full extent, while in children, and in exceptional adult cases, they go beyond it.

Central Operations are those in which the incisions are limited to the central part of the perineum, and are made in the line of the raphé itself, or transverse to it, and lie mainly between the anus and the symphysis pubis. They do not approach the rami, or the great vessels, nor do they run transversely near to the origin of the branches from the pudic artery. In no case do the incisions reach the external limits of the prostate gland.

The distinction is important, and has an intimate rela-

tion to all that follows. It indicates a principle by which to distinguish and classify all the proposals made for the performance of Lithotomy in the perineum.

I. LATERAL OPERATIONS.—There is but one typical form of Lateral Lithotomy, although some of the details of its performance vary in different hands. It is the operation which is at present most widely employed in this country, and is well known as the Lateral Operation. Its origin is believed to be due to Pierre Franco, of Provence, about the middle of the sixteenth century. It was brought into note by Frère Jacques at the end of the seventeenth century; and was largely employed by his pupil Rau, in Holland, in the beginning of the eighteenth. The operation in its present form, however, differs somewhat from their methods, and is for the most part that which Cheselden adopted and practised in London with great success, in the early part of the last century, and which obtained for him a wide and enduring reputation.

II. CENTRAL OPERATIONS. — Belonging to this group there are at least five in number. 1st. The *Median Operation*. The stone was removed by a median incision in the perineum, made close to, and parallel with, the raphé in the old Marian Operation during the sixteenth century, and long afterwards. But the great improvement, and the far greater success which the lateral method realized, led ultimately to the total extinction of the Marian. The disastrous results of this procedure were due, however, to the violent laceration of the neck of the bladder and posterior part of the urethra, by which room was made for the extraction of the stone, and not to the median incision of the urethra, which was all that the knife effected in that operation. This distinction was, nevertheless, lost sight

of by most lithotomists (Ledran may be partially excepted*) until the Italian surgeons, at the commencement of the present century (Manzoni of Verona, then De Borsa, and subsequently Rizzioli) drew attention, by their success, to Lithotomy in the Median Line. Mr. Allarton brought it into notice in this country, publishing his own method of performing the operation and the results, in 1854. This plan has since been frequently tested by others, and has been generally spoken of here as Allarton's, or as the Median Operation. Dr. Buchanan's method, in which he uses an angular staff, first employed by him in 1847, may also be classed under the head of central operations, although it is capable of becoming a lateral operation when required.

The *Bilateral Operation*, so named because the incisions, both external and internal, involved equally each side of the middle line, was designed and made public by Dupuytrèn in 1824. It was subsequently practised in Paris, by himself and others, for some years. As we shall see hereafter, it is, notwithstanding its name, a central, rather than a lateral, operation.

The *Medio-Bilateral*, a combination of the two preceding operations, as the term implies, was published by Civiale in 1836, having previously been practised by him, and subsequently both by himself and others, to some extent in France.

The *Recto-vesical Operation*.—This may be regarded as a continuation of the median operation from the perineum into the rectum, and is supposed to have been designed by Hoffman in 1791, though probably not practised by him.

* See not only his *Parallèle*, Paris, 1730, but Heister's testimony, *Institutiones Chirurg.*, vol. ii. pp. 116-17, and 167; Amsterdam, 1739.

Sanson and Vacca are pre-eminent among those who performed and advocated it in the commencement of the present century.

In entering on the subject of Lithotomy performed in the perineum, whatever be the operation selected, it is necessary to study closely the anatomy of that region. It would, however, be superfluous to enter upon any systematic or minute examination of it here, but I shall call attention to one or two points relating to what is usually termed its surgical anatomy, which appear to me to be important.

A body is supposed to be tied up in the usual Lithotomy position, to expose the perineal region : a region, let it be recollected, *in which deep incisions* are to be made, *and through which* the stone is to be extracted.

It is important to keep steadily in view these two indications, since *the region contains vital organs, and is very limited in extent.*

Therefore—*a.* The incisions must be planned so as to avoid certain parts which it is dangerous to cut ; and—

b. They must be planned so as to secure the greatest amount of space for the passage of instruments inwards and of the stone outwards.

The perineal region is a small space, measuring rarely much more than four inches in any direction, as generally regarded, and its limits are defined in the greater part of its extent by bone. Beneath its surface are the rectum, urethra, bulb, prostate gland, bladder, and the pudic artery, with some of its branches, besides less important parts.

Its surface boundaries are often said to present a space of triangular form ; the apex at the pubic arch ; the base,

a horizontal line uniting the two tuberosities of the ischium. Such a triangle is nearly equilateral, and each of its sides measures in the adult about three inches in length. Such a representation may be convenient to the anatomist, but it is artificial, and for the surgeon not practically true.

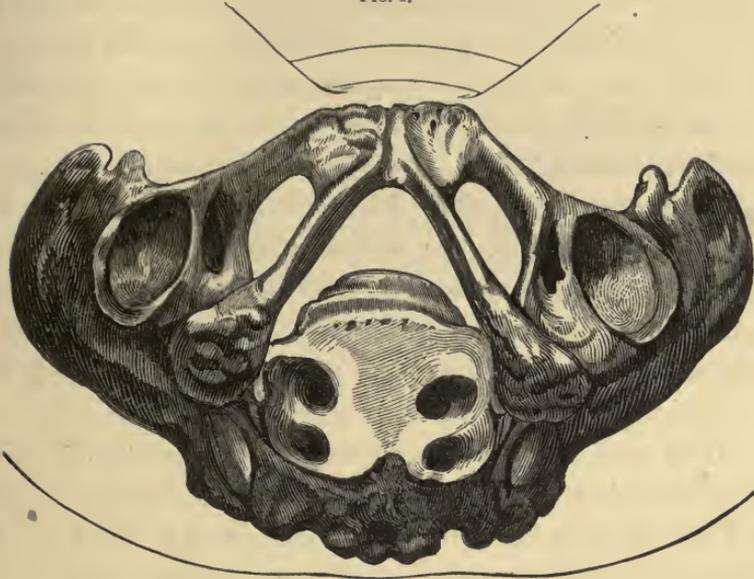
Sometimes the space is said to be lozenge-shaped, in which case the anatomist includes under the term not only the space above described, but another triangular portion, having the same base as the preceding, and the apex at the coccyx; the latter region covering in the lower part of the rectum and the ischio-rectal fossæ.

Now, the surgeon should study for his purposes the anatomy of the male pelvic outlet as a whole, just as the obstetrician has studied that of the female. He wants to know precisely what are the size and form of that outlet, as well as how the important organs are disposed therein. Neither the triangle nor the lozenge rightly represent it in relation to his requirements; while the division of the region into two separate portions for the sake of dissection is unfavourable to the formation of a correct conception of it as a whole. Furthermore, the surgical student must soon perceive that even the two regions thus annexed do not include space enough, either for the first incision required in the lateral operation, or for the removal of a moderately large stone outwards.

The true form of the male pelvic outlet, and consequently that with which we have to do, is that of the conventional heart; the ace of hearts, with the apex upwards.

Take the skeleton of an adult male pelvis, in which the bones are united by their ligaments, and place it in the position for lithotomy. Such an one is faithfully represented by fig. 1.

FIG. 1.



Pelvic bones in the ordinary position for Lithotomy, showing form of outlet.

FIG. 2.

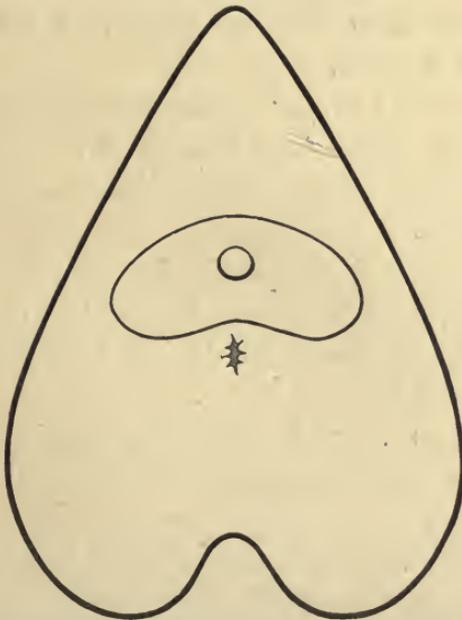


Diagram of the male pelvic outlet, showing the situation of the prostate urethra and anus: drawn on a scale of two-thirds of the natural size.

The apex of the inverted heart is at the lower border of the pubic symphysis ; the diverging sides are the rami of the pubes and ischia ; the rounded lobes of the heart are defined by the great sacrosciatic ligament, and the notch dividing them is formed by the tip of the coccyx.

The pelvic outlet thus described is represented in a diagram adjacent (fig. 2) ; but accurately drawn from the skeleton, on a scale of two-thirds of the natural size. This figure will be employed to represent the outlet throughout this work in connection with the incisions employed in the various operations for Lithotomy.

In a well-developed adult the measurements of this heart-shaped space are as follows :—

From apex under pubic symphysis to the interlobular notch at the os coccygis, about $3\frac{3}{4}$ to 4 inches.

From the anterior part of one tuber ischii to the corresponding part of the opposite bone, about 3 inches.

From the apex to each tuber ischii at the part just named, about 3 inches.

Consequently the two last measurements include a right-angled triangle—the perineal triangle of the anatomist.

From the apex to the centre of the anal orifice, about $2\frac{1}{2}$ to $2\frac{5}{8}$ inches.

From centre of anal orifice to tip of coccyx, about $1\frac{1}{4}$ to $1\frac{3}{8}$.

From the apex to extremity of either lobe of the heart-shaped space, the line of incision in Lateral Lithotomy, about $4\frac{1}{2}$ inches.*

To commence : we will suppose an examination of the region on an untouched subject in the dissecting-room ; or,

* In some bodies the pelvic outlet is more contracted or narrower than the above measurements ; the distance between the tubera ischii being in the adult only $2\frac{3}{4}$ inches, and in a few instances only $2\frac{1}{2}$. This latter condition offers some obstruction to the removal of a large stone, and if the lateral operation is adopted in such a case, its line must be less oblique than usual.

better still, as it appears on the living body. First, there are the projecting tuberosities of the ischium, and from these the upward converging lines of the rami may be traced by the fingers near to the apex, where they are obscured by the body of the penis overlaying them as they approach it. Then about an inch and a quarter below the anal orifice, may be felt the coccyx, and on each side the fingers deeply pressed encounter nothing but soft structures occupying the spaces indicated by the rounded lobes of the heart-shaped figure. In the middle line above the anus, is seen a slight prominence caused by the corpus cavernosum and its enveloping muscle, and placed vertically upon it is the line of the raphé, which divides the region into two equal lateral portions. The anus itself is situated in a deep depression, and a transverse line drawn from the centre of one tuber ischii to another falls just above it.

Observe, that the sides of this space, from the apex to the tuberosities of the ischium, are bone; and that the interlobular notch of "the heart" is bone also; boundaries, therefore, which yield nothing to pressure, and cannot be overstepped by incision. But, on either side of the notch, the tissues are soft and yielding; and incisions in the long axis of either lobe divide no important structure. Danger exists only at the external boundary, in the presence of the pudic artery; in the upper part, from that of the artery to the bulb: and in the central line, from the presence of the bulb itself and the rectum. It is through one of these lobes, and precisely in the direction of its longest axis, that the external incision in Lateral Lithotomy is made; and, which is of equal consequence, it is in the direction of that axis that traction must be exerted when the stone is of large size. It is in the upper and narrower division of

the outlet, viz. that between the anus and the symphysis pubis, that the incisions lie, in all operations which are strictly central, and traction is made directly in the middle line from the perineum to the operator. It can be demonstrated that it is impossible to remove so large a body through an incision confined to this portion of the outlet, and not involving the rectum, as through an incision in the axis of the lateral portion.

Now, every proposal to perform Lithotomy in the perineum must first be tested as to the relation which its incisions bear to the outlet thus described; since, as we shall see hereafter, there is no single cause of death or danger following Lithotomy, greater than that which ensues from the removal of a stone through an insufficient or an ill-placed opening.

Bearing in mind the form of the space, let us proceed to make a surgical, not a minute or anatomical, dissection of it. The latter is absolutely necessary in its place, but that is not here. We want now only the salient points, to refresh the memory, not to encumber it with non-essentials.

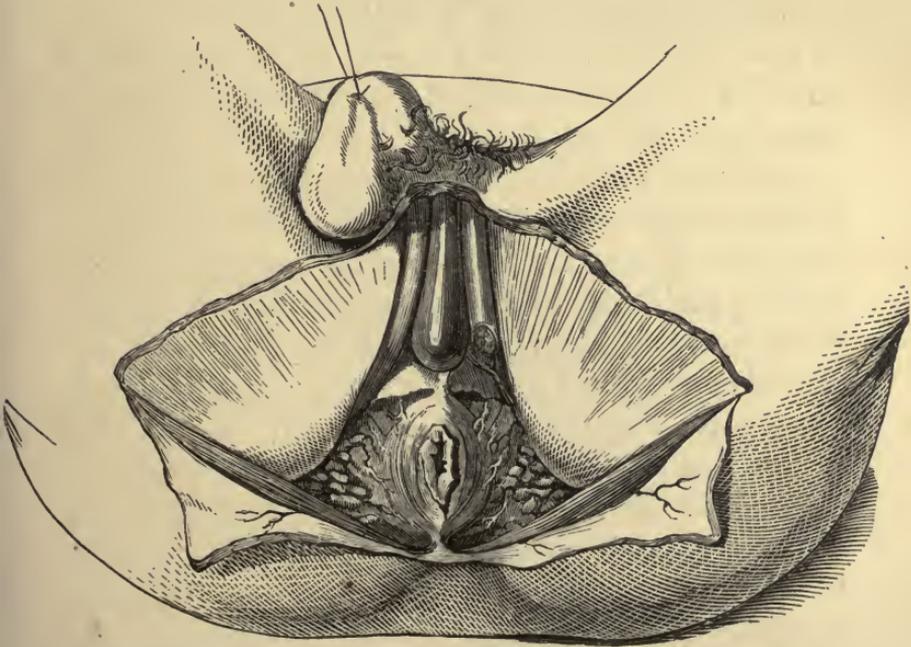
Without entering on the details of the process, let it be supposed that the skin, cellular tissue, and fat are removed: this completes the first stage of dissection.

The accelerator urinæ muscle occupies the middle line at the top of the space, and the sphincter ani surrounding the end of the rectum continues the line below it. The space is crossed transversely by the two transversus perinei muscles; and the erector penis lying on the pubic ramus of each side, forms one side of a triangle, of which the transverse muscle is the base, and the accelerator the remaining side. From this are seen issuing the superficial

perineal artery and nerve, with their branches. Below the transverse muscle is the ischio-rectal fossa, with a few unimportant branches of artery and nerve permeating it. The central point of the perineum is seen between the bulb and anus, where the four muscles unite in a crucial form. All these are superficial to the triangular ligament, or deep fascia, of the perineum.

The next stage of the dissection removes these muscles, and exposes the corpus spongiosum and the corpora cavernosa of the penis: the deep perineal fascia is seen in the intervals. Here (as represented at fig. 3) it is left untouched on the right side of the subject, while it is removed, together with the compressor urethræ muscle, on the left, to show the course of the pudic artery, and its

FIG. 3.



The second stage of the dissection of the perineum, showing the course of the pudic artery, and artery to the bulb, the fascia, &c.

branch the artery to the bulb, which lie beneath it, the latter perforating the fascia. The left corpus cavernosum is also divided to show the arteries more clearly. The position of these vessels forms the important point of this dissection.

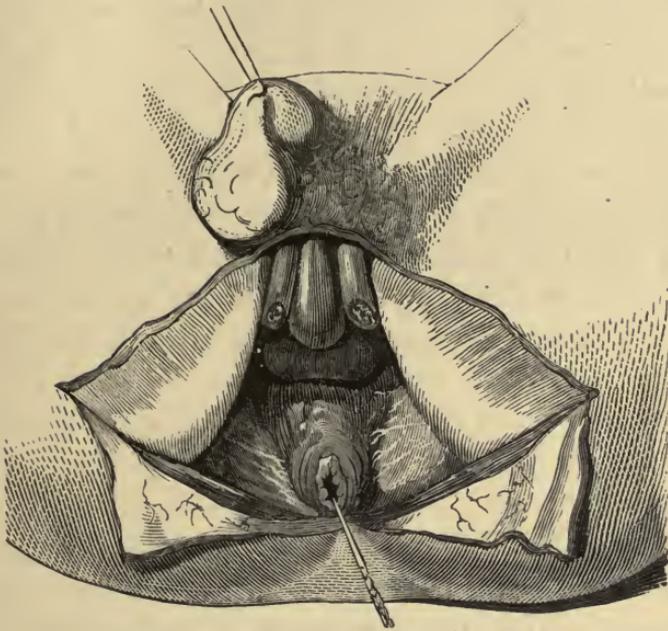
The last stage of the process consists in clearing away the whole of the perineal fascia, the vessels just named, and the deep fascia, now usually known as the pelvic fascia, which lies beneath the vessels, and forms a sheath for the prostate gland. The fibres of the levator ani having been divided on each side, the rectum is drawn downwards, and carefully separated from the prostate, maintaining the latter as much as possible in its normal position. To illustrate the situation of this organ and neck of the bladder is the object of this, the last, dissection. The result is shown by fig. 4.

After this brief anatomical *resumé*, it will be easy to see what parts must be divided in the various modes of operating in this region.

In Lateral Lithotomy the following parts *must be cut*.—The skin and superficial fascia; the transverse muscle of the perineum and transverse perineal artery; the deep perineal fascia, the membranous urethra, and muscular fibres surrounding it; a little of the levator ani, the prostatic urethra, and part of the prostate gland itself. In addition to these, the following parts may be, and often are, cut:—a part of the accelerator urinæ muscle covering the bulb of the urethra, and a little of the bulb itself; also the internal meatus at the neck of the bladder: Occasionally, especially when the vessel is given off lower down than usual, the artery to the bulb is divided also.

In Central Lithotomy the following parts *must be cut*

FIG. 4.



Deep dissection, showing the situation of the prostate in the pelvic outlet.

The skin and superficial fascia ; the tendinous structures which unite the muscles in the central point of the perineum, and a few fibres of the accelerator urinæ muscle. Some small arterial branches anastomosing across the middle line. The deep fascia, the membranous urethra, and muscular fibres surrounding it ; the prostatic urethra, and a little of the lower part of the prostate gland itself. In addition to these, the bulb of the urethra is generally divided to a small extent ; and when deep lateral incisions are made also, the prostate gland is divided in the direction named, with a little of the deep fascia right and left of the median line and the muscular structure contiguous to it, as well as the internal meatus, according to the design of the operator.

Further: it will appear that, in order to introduce any large instrument, or to remove any large body by the Lateral Operation, room must be provided in the direction of the lower angle of the wound. The pubic arch limits the space unalterably, in front, the ramus of the ischium equally so on the outer side; the rectum and coccyx occupy the middle line. Hence, in withdrawing a large stone from the bladder, traction must be made obliquely downwards and to the right side of the operator in the direction of least resistance, which is towards the hollow of the sacrosciatic ligaments, where the fibres of the gluteus muscle only cross the heart-shaped space which has been already indicated as forming the true outlet of the male pelvis.

Lastly: it will be equally obvious, that in the performance of Lateral Lithotomy, the following parts *are to be avoided*. In front, the artery to the bulb, and the bulb itself. In the median line, the rectum. On the outer side the pudic artery; which, however, could only be endangered by the most reckless incisions; still, its situation, at the margin of the ramus bounding the space there, is always to be remembered. In the last or deepest incision the boundary limit of the prostate is not to be overstepped in the adult, whenever the stone can be removed without doing so; but this point will be discussed at length when we consider the steps of the operation itself.

In central operations (the recto-vesical excepted) the rectum must be avoided in the lower part of the incisions; and it should be the aim of the operator to avoid the bulb above, or to wound it as little as possible. Respecting incisions in the prostate, as in the preceding case, more will be said hereafter.

CHAPTER II.

THE LATERAL OPERATION OF LITHOTOMY.

The Instruments necessary.—Preliminary Proceedings ; Assistants, &c.—The First Stage : Management of the Staff ; finding the Stone.—Second Stage : the Incisions superficial and deep ; probe-pointed Knives ; Gorgets ; Lithotomes.—Third Stage : Removal of the Calculus.—Fourth Stage : the Tube ; Treatment of Hæmorrhage, &c.—The after Treatment.—Aston Keys' Operation.

I SHALL first enumerate the instruments which it is desirable to have ready for use before performing the operation of Lithotomy by the lateral method. The non-appearance of a single instrument of importance at the moment it is required may produce great embarrassment to the operator ; hence a list should be at hand by which the instruments can be selected the day before the operation.

Sounds of the proper form for detecting stone in the bladder (fig. 5).

FIG. 5.



An eight-ounce syringe (fig. 6), with suitable catheter for injecting by urethra ; and a tube for washing out the

bladder by a reversed current through the wound after the operation (fig. 7).*

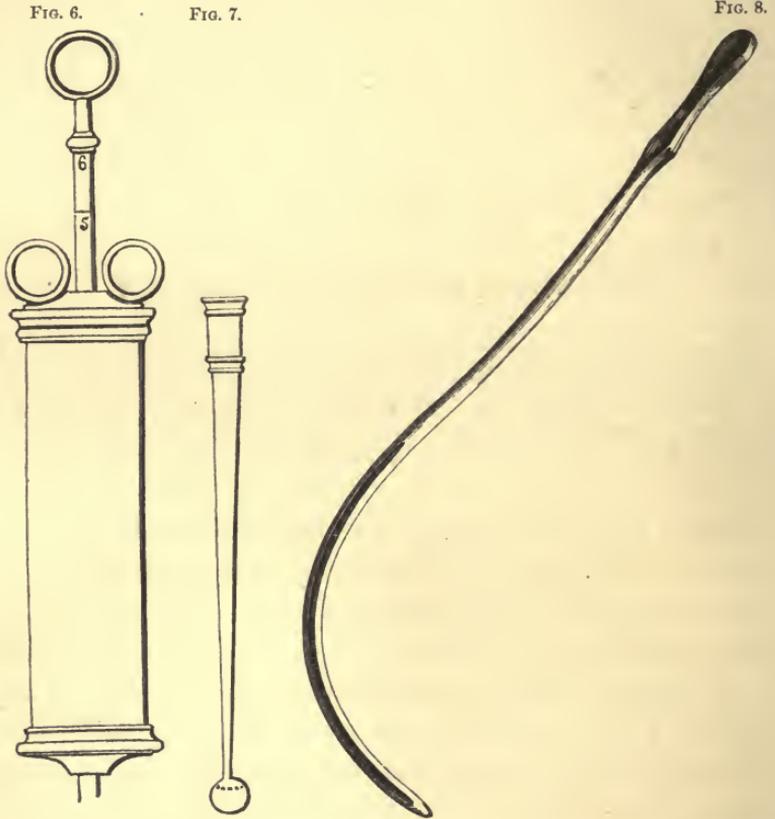


Fig. 6. The syringe, with graduated piston rod.

Fig. 7. Nozzle for reversed current.

Fig. 8. Staff, with lateral groove.

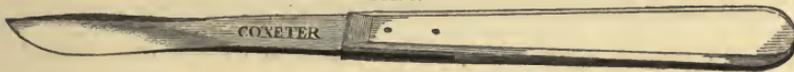
Full-sized staffs, as deeply and widely grooved as their size admits, consistently with maintaining their strength. The groove to be midway between the convex and the lateral aspects of the staff, to stop abruptly half an inch

* This nozzle is after the suggestion of Dr. Gross of Louisville, *Urinary Organs*, 2nd ed., p. 560.

from the extremity, and not to extend so far up the handle as to permit the urine to escape (fig. 8).

A knife, of which the blade and handle together measure (for the adult) about $7\frac{1}{2}$ inches long; of this, the blade may be about 3 or $3\frac{1}{4}$ inches. The cutting edge should have a length of about one inch from the point: for form, &c., see fig. 9. Smaller sizes are required for young subjects.

FIG. 9.



A second knife, of which the blade and handle may measure together about 8 inches; of this the blade may be about $3\frac{1}{2}$ inches. A large probe point should terminate the blade, and it should be so constructed that it may run easily in the groove of the staff. The cutting edge should extend to about $1\frac{1}{4}$ inch from the point (fig. 10).

FIG. 10.



A blunt gorget about $5\frac{1}{2}$ inches long, exclusive of the handle, curved from side to side and terminated by a probe point, to run in the staff (fig. 11). This is a useful

FIG. 11.



See other gorgets at p. 36.

instrument where the perineum is so deep, or the prostate so large, that the finger cannot reach the bladder, as occasionally, but rarely, happens.

Forceps of various forms and sizes. It is desirable to have the blades of good length, so that the angle produced by opening them is acute rather than the reverse : a better form of wedge is thus presented to the orifice, through which the instrument and the stone have to pass. The inner surfaces of the blades should be slightly roughened ; they are sometimes lined with very thin canvas or kid leather, to afford a surer hold, and avoid any crushing of the stone itself. The extremities of the blades must not meet ; an interval of about one-eighth of an inch should exist between them when the instrument is closed. It is necessary to have curved as well as straight forceps. (Useful forms are shown at figs. 12 and 13.)

FIG. 12.

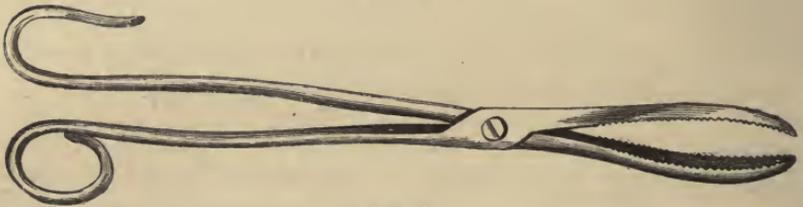
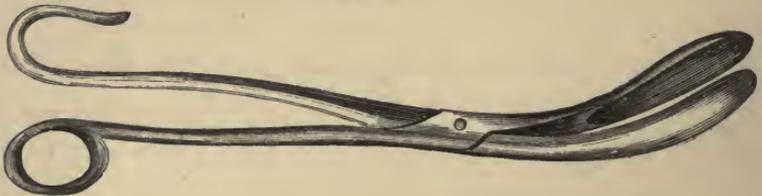


FIG. 13.



A scoop is sometimes very useful, and succeeds in certain circumstances in removing a stone or fragments, better than the forceps (fig. 14).

FIG. 14.



An instrument for searching the bladder after the operation, in case another calculus or fragments may still remain there. Nothing answers better than the sound represented at fig. 5.

A strong instrument for crushing a calculus of unusually large size, and requiring to be broken before removal, is occasionally necessary. Several forms have been designed, but almost all consist of a pair of ordinary strong forceps, with screw or other power to approximate the handles. (See Chapter VI., pp. 112, 113.)

A pair of worsted web lithotomy garters, strong, but pliant; each measuring not less than three yards. An anklet, to accomplish more easily and more securely the same purpose, has been designed and employed by Mr. Prichard, of Bristol. (Figs. 15 and 16.)

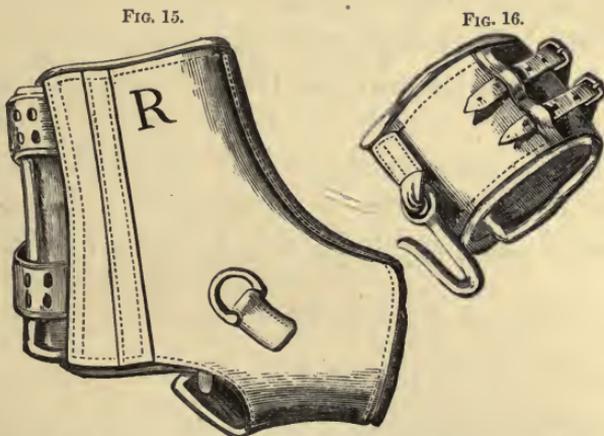


Fig. 15. Mr. Prichard's anklet.

Fig. 16. The wrist-piece.

His description is as follows:—"These straps consist of padded leather bracelets fitting to the wrists, and buckling firmly round them; and some firm leather anklets, of the shape of the elastic bandages for the ankles, which can be

buckled on over the ankles. The bracelets have a strong hook on the middle of their palmar aspect, and opposite each outer malleolus is an iron ring. The bracelets and anklets being put on when the patient is in bed, as soon as he is under chloroform, or the staff is introduced, the hooks are passed through the rings and all is done.”* During the last few months I have myself used these anklets in three cases of lithotomy, and much prefer them to the garters for ease in application, and for security afterwards.

A tube to be introduced through the wound into the bladder, after the operation. One may be specially fitted for plugging in case of deep venous hæmorrhage. (Fig. 17.)

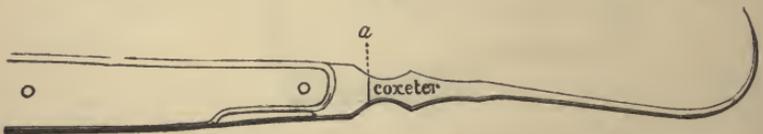
Ligatures ; artery forceps ; curved needles and strong silk, tenaculum (fig. 18) to secure any deeply-seated arteries (see Treatment

FIG. 17.



The tube surrounded with a piece of thin calico, or oiled silk, to remain the plugging in case of hæmorrhage.

FIG. 18.



Tenaculum (Dr. Keith). At *a*, the hook unites with the handle by a screw, and can be separated from it, for the purpose of leaving it in the wound beneath a deep-seated vessel after tying round it, when the ligature cannot be secured otherwise.

following the operation under the head Hæmorrhage, page 43) ; bandages, sponges, lint.

* Brit. Med. Journal, Dec. 22, 1860, p. 993.

Other appliances.—Vessels containing hot and cold water, one of the former to heat the forceps and other instruments : napkins in abundance, oil ; chloroform is of course to be given. Brandy, wine, smelling salts, and chloric ether, or sal volatile, should always be within reach.

The operator should himself see that there is a strong, firm, and steady table, of proper size, and capable of being placed in a good light. The table should be 2 feet 8 or 9 inches high, if the operator is seated in a chair of ordinary height ; but a table of almost any height will do, if the relative proportion between it and the chair be maintained. The operator should be seated rather too low than too high. The fore-arms should not occupy a horizontal line when operating, but incline upwards to the patient's perineum. Some surgeons prefer the kneeling position, with one, or even both knees resting on the floor. A blanket folded once or twice, and covered with some waterproof cloth, should be placed on the end of the table, over which the patient's buttocks will be brought. Pillows or cushions will be required to support the head and shoulders. A shallow vessel containing sand or sawdust is useful to protect the floor from blood, urine, &c.

THE OPERATION.—It is usual to ensure action of the bowels by an aperient, on the day before the operation ; if, however, they have been regularly and sufficiently moved in the natural manner, a purge is undesirable, since it only weakens the patient. But on the day of the operation, and about two or three hours previous to it, a full enema of warm water should be given. The surgeon should ascertain that the action of this has been efficient and

completed at least an hour before the operation, or he may find the rectum distended, and about to act when the patient is on the table; a condition in which the chances of wounding the bowel are augmented. By pursuing this method time is also given for a few ounces of water to collect in the bladder if desired, which would probably have been emptied simultaneously with the bowels. The left side of the perineum may be previously shaved with a common scalpel or a razor.

[Some surgeons, and especially at the present day, regard it as important that there should be a considerable quantity of water in the bladder. I venture to express an opinion that its use is overrated; and that it is sufficient to take the chance of the urine accumulating for an hour before the operation; at all events, any attempt to inject an irritable bladder is rarely of any service. Cheselden expressly says that he prefers the bladder empty, as the stone is then sure to be found close to the internal incision at the neck; whereas if the organ is full it may entangle the stone in its folds as it collapses. Mr. Crichton was of the same opinion, and insists, in his MS. notes, that if the bladder is empty, or nearly so, the stone is certainly found at the neck of the bladder.]

ASSISTANTS.—There should be one steady, experienced assistant to hold the staff; it is his duty to follow implicitly the operator's instructions throughout. Two others also are necessary, each to support firmly a leg of the patient; one of them to draw the scrotum a little upwards, and to the right side; or this may be done by the assistant who holds the staff. These suffice, in addition to the physician who administers the chloroform. Another may be sometimes useful to hand sponges, ligatures, &c., or to supply any want of the patient; all of which, how-

ever, may be done if need be by a nurse. The instruments should be carefully arranged by the operator himself (on a tray or otherwise), within easy reach of his right hand, so as not to be touched, and possibly deranged, by an assistant.

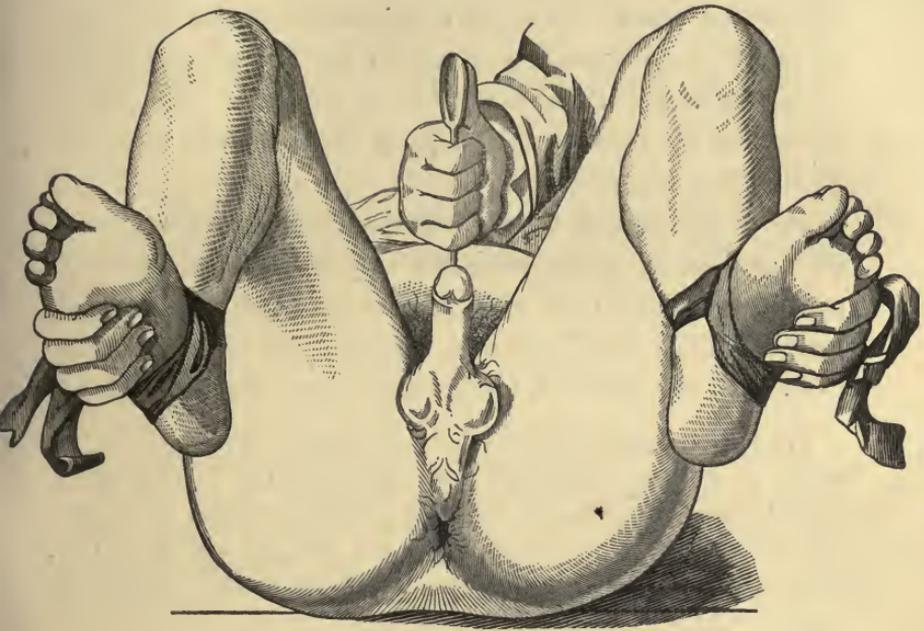
I. All the preliminary arrangements being complete, the patient should be placed on the operating table, and be sufficiently covered with blankets. Chloroform having been administered, the staff should be carefully introduced, and the stone found, and struck by it if possible, the click being heard by the operator, and by one other person at least. If it cannot be felt with the staff, a sound of the proper form should be introduced, the bladder explored, and unmistakable signs of the presence of calculus elicited. It may be necessary in order to discover it, to inject a little warm water, particularly if the bladder has emptied itself during the sounding. If, after a fair search, the stone is neither heard nor felt, no operation can take place, and the search must be resumed on another day.

[But it is very desirable, and in most instances it is possible, to strike the stone with the *staff itself, upon which the patient is to be cut*. Because, supposing the stone to be struck with the ordinary sound, and some difficulty is experienced in passing the staff subsequently, it is possible that the operator has made a false passage, and unwittingly passed the instrument out of the urethra altogether. Or, the staff may have passed into an old false passage, which the sound, having a different curve, escaped. The obvious consequence is, that any operation performed on a staff so placed will not lead into the bladder, no stone will be removed, and the discovery of the error may not take place until it is too late to repair it. This unhappy accident has been known to occur, not very unfrequently, particularly in children. It could not happen if the surgeon were determined to hear the stone struck with the staff

itself; and, especially if he has not had much experience, nothing else should satisfy him. An experienced surgeon knows whether the staff is in the bladder, without feeling actual contact with the stone, by the degree of mobility possessed by an instrument rightly passed, strongly contrasting with its fixed condition, when passed out of the urethra; but the rule is a good one to make generally binding nevertheless. It is especially necessary in young cases, because a staff passed into the cellular interval existing between the rectum and bladder, has often a good deal of mobility, and thus is believed to be in the vesical cavity.]

The staff being placed in the bladder, the patient's head and shoulders should be a little raised by two or three pillows, and the hand and foot of each side tied together. An assistant extends the right arm by the patient's side, and drawing up the right foot by flexing as much as possible the knee and hip joints, places it in the hand so that the palm embraces the outer side of the instep, and the fingers lie transversely below the sole, with the thumb across the dorsum. A lithotomy garter is folded double, with a running noose at the doubled end, which is placed round the wrist; the two free ends are then crossed tightly under the sole and round the ankle, so as not to slip, and finally are tied with a bow on the outer side. Meantime the opposite limbs are similarly treated. But Mr. Prichard's anklet, described at page 21, bids fair to supersede the ancient method by garter, which is often inefficiently performed, and so becomes a source of embarrassment to the operator. When all is made secure the buttocks are brought down until they project slightly over the edge of the table (fig. 19). Each leg is firmly and steadily held by an assistant, who, facing the operator, places his nearest hand (*e. g.* his left if standing on the

FIG. 19.



The position of the patient when tied up for Lithotomy.

patient's right) on the inner side of the patient's knee, while his other grasps the patient's foot, keeping it well backwards and outwards. The staff is confided to an assistant who stands on the patient's left, and takes it in his own right hand. He should hold it so that the handle is perpendicular and strictly in the middle line, neither deviating to the right nor to the left ; and as there must necessarily be some base of support in so doing, it should be made to rest steadily but lightly against the lower border of the symphysis pubis. In this position, from one to two inches of the staff ought to be lodged in the bladder. With his left hand he may gently draw up the scrotum a little towards the right groin, and so keep it out of the way.

The operator, having placed the necessary instruments within his reach, takes his seat, and separates the legs as much as he deems necessary to expose sufficiently the perineum and part of the buttocks adjacent. He ascertains that the position is square to the front, and that the patient is firmly placed.

By a glance, and by passing the fingers over the perineal surface, he observes whether the tubera ischii are wide apart, or whether they approximate more than usual; and he plans the line of the first incision somewhat in conformity with the result of his examination. (See page 10.)

[Different authorities give different directions respecting the mode of holding the staff. Some prefer the convex part slightly projecting in the left side of the perineum; but the instructions given above describe the method which at the present day is pretty generally pursued by most experienced operators in this country.]

II. The operator commences by introducing his left forefinger into the rectum to ascertain that it is empty; a proceeding which appears also to have the effect of stimulating the bowel to contract and occupy the smallest possible space. He then places the fingers of the left hand upon the upper part of the perineal region to maintain the skin in its place, not to draw it upwards; and holding the sharp-pointed knife in his right, commences the first incision about a quarter of an inch to the left of the raphé, and an inch or a little more in front of the anus, carrying the blade downwards and outwards for about three inches in a direction about midway between the anus and tuber ischii, but inclining a little nearer to the latter. The knife should, at its point of entry, divide the skin, and quickly sink more deeply towards the staff, the

situation of which should be kept in the mind's eye, into the superficial fascia and fat in the hollow which exists between the bulb and anus on the one side, and the ramus of the ischium on the other ; this fossa corresponds, therefore, to about the upper half of the incision, which is to be gradually made more superficial through its lower part. If a large stone is anticipated its entire length may extend to about three and a half inches. As a rule, then, the first incision should be free.

[The line of the first incision is somewhat differently taken by different operators. Nearly all agree to commence a little to the left of the raphé, but not so in regard to the distance in front of the anus. Thus, Mr. Fergusson directs that it should commence one inch and three quarters in front. Mr. Erichsen one and a half inch. Sir B. Brodie, Mr. Stanley, Mr. Skey, and Dr. Gross, advise one inch and a quarter, while Mr. Coulson and Dr. Keith of Aberdeen direct that it should commence at one inch only in advance. The latter attaches considerable importance to this point, and argues in its favour at some length in his work on the subject.* Mr. Crichton always made his incisions low : I infer from his notes, as near as possible to the last-named spot.

It is quite clear, also, that Cheselden, himself, commenced not more than one inch in advance of the anus.†

The directions given by other well-known operators are not expressed in precise terms, and on this account they are not quoted. Now, as it appears that nearly all advise an external incision of about the same length, that is, of three inches or thereabouts for an adult patient, it follows that the situation of the opening relatively to the pubic arch and to the bladder must differ, and somewhat materially. This discrepancy has sometimes been the source of perplexity to the student; al-

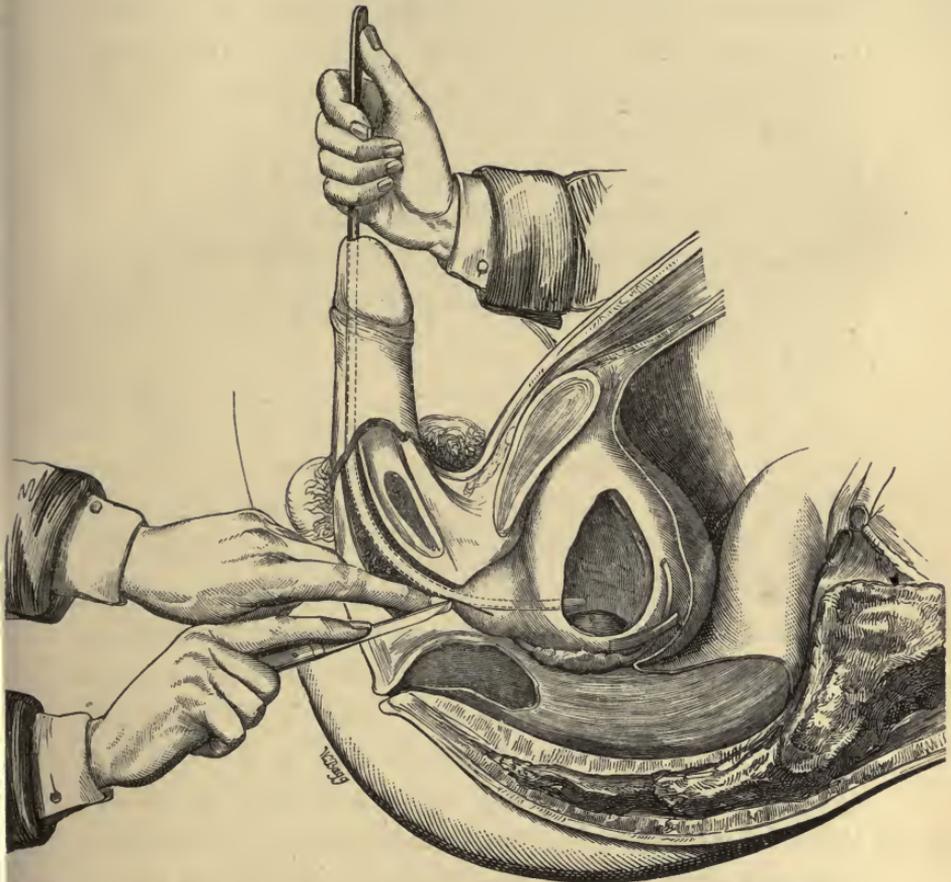
* Hospital Statistics of Stone, pp. 17-21. By Dr. Keith, Aberdeen, 1849.

† Cheselden's Anatomy of the Human Body. 5th ed. 1740 ; 6th ed. 1750.
 " I first make as long an incision as I can, *beginning near the place where the old operation ends.*"

though it is true that where the incisions are commenced high up, the skin only is cut at first, and where they are low, the knife is made to penetrate into subjacent tissues at once, so that, in any case, the deepest part of the incision is made into the hollow between the accelerator and the erector penis muscles, just beneath and outside the bulb of the urethra. Nevertheless, it is the safer practice to err, if it be an error, by placing the incision too low rather than too high. The low incision avoids the bulb and the artery thereto; it enters the urethra in the membranous portion, or just at the apex of the prostate; and it places the axis of the wound in its best relation to the pubic arch, that is, as far as possible from that unyielding boundary of the perineal space. It thus affords room for removing a large stone, and lessens the chance of bruising the neck of the bladder with its external cellular relations in the act of extraction, the danger of which will be pointed out in Chapters V. and VI.]

The left forefinger now enters the wound and separates a little, especially at its deeper part, the fat and fascia in the direction of the staff, which should at this stage be just felt beneath them, guarding, at the same time, the rectum by pressure downwards and inwards, while the knife follows, and by an additional small stroke or two enables the operator to define clearly the line of the staff, and press his finger-nail into the groove where it lies in the membranous portion of the urethra just in front of the apex of the prostate. Guided by the nail, he carries the point of the knife into the groove at this spot, and he holds the knife so that the blade is neither vertical nor horizontal, but inclining rather more to the latter direction, while the point is directed a little upward. This important stage of the operation is illustrated by the annexed woodcut (fig. 20), in which the parts are shown by an anatomical section. The knife is now pushed steadily

FIG. 20.



Anatomy, in section, of parts interested in Lithotomy. Position of hands in last incision.
 [Mr. Bagg has represented this for me very carefully, from a dissection made expressly for the purpose.]

along the groove of the staff into the bladder, the operator being careful to remember that the depth of the incision in the prostate very much depends on the angle which the blade makes with the staff in that act. The hand, therefore, must not be lowered too much; if a small incision is required, the knife is to be maintained very nearly in a line with the extremity of the staff, so as to make an acute

angle with it; the point being kept up only enough to insure its transit clearly and closely along the groove, which must not be quitted for an instant. When the bladder has been entered, the knife is withdrawn to make way for the finger, but if the operator is of opinion that more room is wanted he can enlarge the incision to the extent deemed necessary while withdrawing the blade, by carrying it outwards and downwards, in the line of its entry, so that the edge sweeps lightly along the outer angle of the wound.

The operator now slips the point of his left forefinger into the groove of the staff, and along it, slowly and steadily through the wound in the prostate, slightly dilating it as it passes, until the last joint enters the vesical cavity (as it will in ordinary cases), and comes into contact with the stone, mostly felt lying at the neck of the bladder. In this position he is enabled to ascertain its situation, and, at the same time, to make a kind of hold upon the bladder, and maintain his communication with it. He now orders the staff to be withdrawn, and taking a pair of long straight forceps, introduces it by sliding the wedge-shaped extremity very slowly and gradually outside the finger, but along its palmar aspect, until the blades are fairly within the bladder. It is manifest that additional dilatation of the wound in the prostate must be made in this act; and it is a matter of the highest importance that the forceps should not be thrust in so as to form a rent in the soft tissues, but that the operator should coolly, deliberately, and slowly insinuate them in order to dilate gradually as much as may be necessary, and rupture as little as possible. Meantime a little of the urine will probably escape by the wound.

[The mode of making the last or deep incision through the prostate and neck of the bladder is one which has been at all times regarded as possessing the highest interest for the lithotomist, and demands special attention. It has been described here as made with the sharp-pointed knife employed in the earlier stage of the proceeding. Such appears to be on the whole the prevailing practice among metropolitan operators. Nevertheless, other means, and a great variety of instruments, have been largely and are still employed in its performance, for the purpose of attaining, as it is believed by those who advocate them, more safety and certainty in the incision. Two principles of construction, and two only, have been adopted in the numerous forms of knife, bistoury, or gorget, which have been invented from time to time in order to accomplish this end. The first principle has been to give the instrument, whatever its form or name, a blunt probe-point, which shall run easily along the groove of the staff, and be incapable of doing mischief if by mishap it gets out of it. The other principle of construction consists in giving to the blade of the cutting instrument such a width as to determine the exact depth of the incision intended; to ensure that this depth shall not depend on the will, and manipulative execution of the moment exercised by the operator, which may of course vary, but solely on the pre-arranged depth of the blade itself.

These principles serve to classify all the very numerous instruments referred to, and reduce them to a position in which we can consider their merits.

The instrument which illustrates the first-class is the simple probe-pointed knife, or bistoury; one of the earliest and best-known forms being that of Sir Wm. Blizard, whose name it still bears (fig. 21). This, or some other form of it, of which several are exhibited in the adjacent figures, has been used by many of the best operators in order to make the deep or final incision, on

FIG. 21.



Sir William Blizard's probe-pointed knife.

the alleged ground of its complete efficiency and superior safety to the sharp-pointed knife. But before exchanging his scalpel for this instrument the operator is very careful that the opening made into the urethra upon the groove of the staff is sufficiently large to admit the probe-point easily, and he secures the opening with his finger-nail during the change. Provided this is accomplished, there is no possible objection to the use of the probe-pointed knife, and if an operator has a conviction that it is safer in his own hands than the sharp-pointed scalpel, he should certainly employ it. With regard to any liability to injure the bladder in the use of the scalpel, *if it exists*, there can be no hesitation as to the propriety of adopting the guarded point. It is said that the opposite wall of a bladder has been perforated by the scalpel in Lateral Lithotomy, but in such a case its point must have left the groove in the staff, and have been freely exposed in the bladder, an act which, under no ordinary circumstances, can form part of the operation.

For the numerous varieties of instrument, designated by the term gorget, which illustrate the second principle of construction referred to, the probe-point also is always employed. Nevertheless, the opponents of the gorget condemn it mainly because it is alleged to slip out of the groove, although it possesses the same guide which is believed to preserve the knife in its place. This discrepancy requires to be explained, and it is not difficult to do so. The slipping of the gorget is not necessarily due to inherent vice in the instrument, but in part to the particular mode of applying it, which has usually, but not invariably, been pursued; viz. to the depressing of the handle of the staff by the operator's left-hand at the precise moment when with his right he thrusts on the gorget to the bladder. Thus the groove in which the beak is destined to run is suddenly raised, and loss of contact is liable to result, especially if the left side of the instrument like the first cutting gorget (of Hawkins) had a convex shoulder. Cline removed this disadvantage, making the left side straight, and placing the beak at the end of it. The practice of this double movement must, I think, be regarded as a principal cause of the slipping of the gorget. Had the staff been held steady

throughout, as is the usual mode in modern Lithotomy (Mr. Key's operation excepted), the gorget could have traversed it as safely and as certainly as the probe-pointed knife. The double movement is doubtless to be done safely enough, but it might be hazardous in the hands of any but an adept.

A second and an influential cause of slipping existed in those gorgets, the cutting edge of which forms an obtuse angle with the back of the blade; so that the bladder was pushed before the instrument, instead of being penetrated by it. This objection was also overcome by Cline who gave it an acute angle. The various gorgets which have formed the leading varieties of this instrument from its first employment as one of the instruments in the "apparatus major," or Marian Operation, to the present day, are shown in the wood-cut on the following page.

The famous charge of John Bell, that "the gorget slips! and all the surgeons of Europe confess it,"* has been repeated perhaps too readily, doing much to discredit an instrument with which we should not forget that some of the most successful practice in this country has been accomplished.† But why it should slip more than the probe-pointed knife, if similarly used, does not appear, and has never been explained satisfactorily.

The essential practical difference between the two instruments is this: that, with the narrow-bladed instrument, or probe-pointed bistoury, the depth of the internal incision depends on the angle it makes with the staff when pushed through the prostate and withdrawn; while with the gorget, the depth of the incision depends mainly on the breadth of the blade; that the wound shall not be too small is thus ensured, and it will not be too large unless the gorget is too wide or is not kept, as it enters the bladder, closely in a line with the staff.

Sir Benj. Brodie used and recommended a probe-pointed knife, of which "the blade is broad enough to divide a considerable portion of the prostate as it enters the bladder,

* Principles of Surgery, 1826, vol. iv. p. 227.

† Mr. Green cut forty cases with the cutting gorget (of Cline) without a single casualty. Cline himself was very successful. It was usually about three-quarters of an inch wide, and one inch for cases of enlarged prostate.

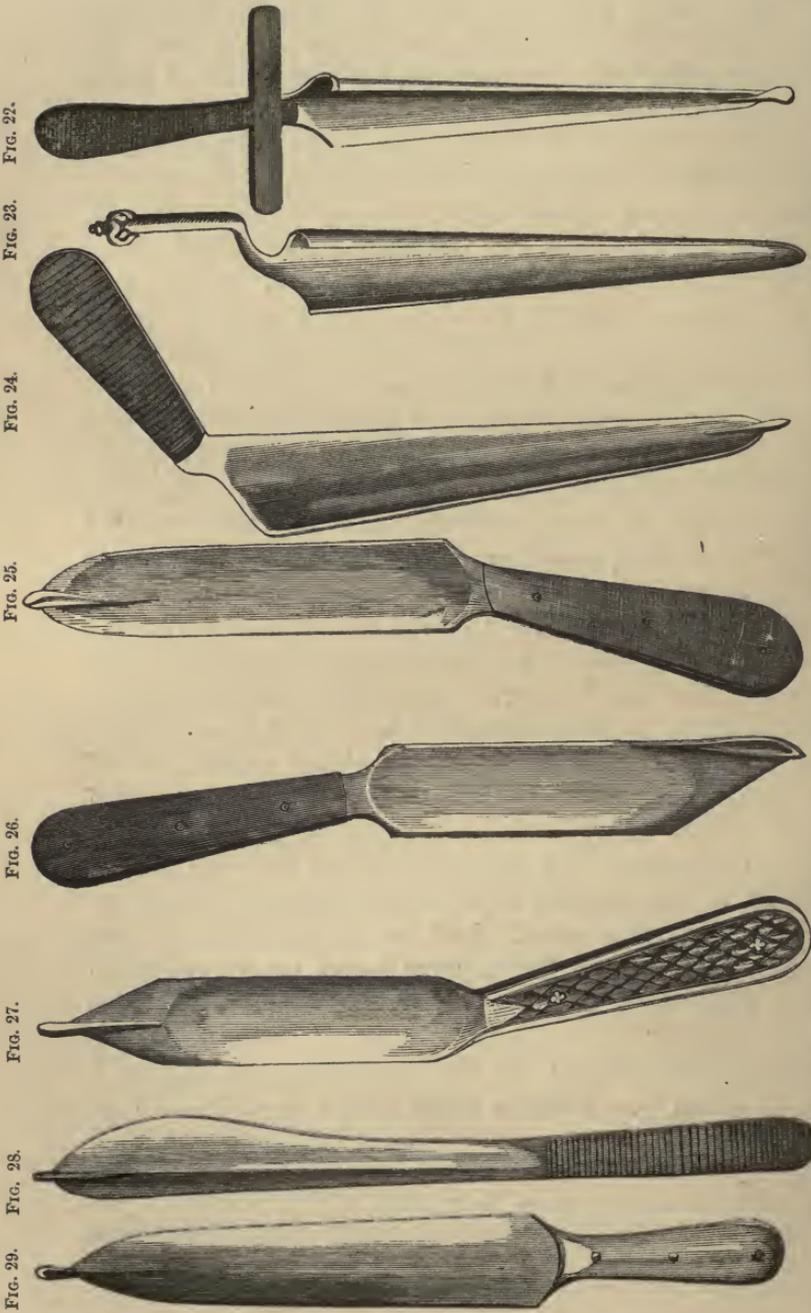


Fig. 22. Instruments used as dilators of the urethra and neck of the bladder, in the "apparatus major," or Marian Operation.—Heister, Institut. vol. ii. tab. 28.
 Fig. 23. The dilator of Cheselden.—Heister, Institut. vol. ii. tab. 31, fig. 9.
 Fig. 24. The cutting gorget of Hawkins.—Savigny's Collection of Engravings of Surgical Instruments.—Lond. 1798, pl. iv. fig. 1.
 Fig. 25. Cline's gorget.—Savigny's work, pl. iv. fig. 3.
 Fig. 26. Sir A. Cooper's double-edged gorget.—Idem. pl. vi. fig. 4.
 Fig. 27. Scarpa's gorget.—From one sent by Professor Scarpa to Mr. Crichton, of Dundee, now in my possession.
 Fig. 28. Dr. Keith's gorget.—From one in my possession.

without its being necessary to increase the size of the incision by cutting laterally afterwards." This was really neither more nor less than a narrow-cutting gorget (fig. 31).

John Hunter's lithotomy knife was wider still, and was, indeed, a cutting gorget in disguise (fig. 30). So was Langenbeck's (fig. 32), which had a spring catch, converting it, at the operator's will, into a probe-pointed knife. The knife which Mr. Smith, of Leeds, uses constantly, and with much success, is a wide-bladed, probe-pointed knife. He has four sizes, adapted to the requirements of different cases (fig. 33). Between all these broad knives, and a well-made cutting gorget of moderate width, there is really no essential difference.

Dr. Keith, of Aberdeen, uses a peculiar gorget; for ordinary cases, one which is seven-eighths of an inch wide; and for cases of enlarged prostate, one which is one inch and an eighth wide (fig. 29). The peculiarity of his instrument is this: that its edge,

FIG. 30.

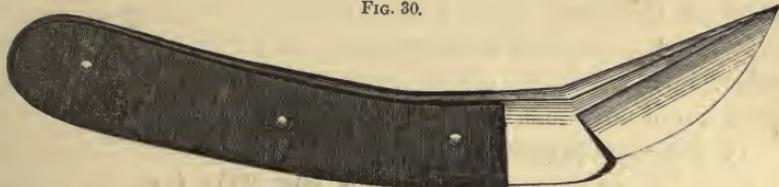


FIG. 31.

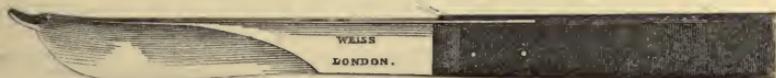


FIG. 32.



FIG. 33.



Fig. 30. John Hunter's knife.—Savigny's work, pl. iv. fig. 12.

Fig. 31. Sir B. Brodie's knife.—From one in the possession of Messrs. Weiss and Son.

Fig. 32. Langenbeck's knife.

Fig. 33. Mr. Smith's (of Leeds) knife.—From one sent by Mr. Smith to the author.

made at first sharp by the cutler, is afterwards just blunted by himself with a file. It thus divides the substance of the prostate through which it is pushed, but is quite incapable of incising in any way the coats of the bladder. But it is to be recollected that he makes the deep incision with the probe-pointed knife first, and then employs this to extend it and to conduct the forceps. Through his kindness I possess the identical instruments which he has used in about 120 cases. The form of Dr. Keith's gorget is very nearly that of Cheselden's instrument as drawn in Heister's surgery (see fig. 24); but it tapers a little less than that of Cheselden. Mr. Crichton also employed the cutting gorget in a very large proportion of his successful cases. He subsequently employed the probe-pointed knife, continuing to use the gorget still in cases of deep perineum and enlarged prostate. The two gorgets which he employed (which are also in my possession) are made on the pattern of Cline. It is only fair to state that most of his worst cases were cut with it, the very cases in which his success was so remarkable; and that he confessedly substituted the knife on account of the outcry against the gorget, and not because he disliked the latter.

To this same principle of construction belong the "bistouries cachées," or lithotomes of all kinds (fig. 34); *i. e.* the depth

FIG. 34.



Fig. 34. The lithotome or "bistourie cachée," as used by many foreign surgeons to make the deep incision. A, a screw which regulates the extent to which the blade protrudes from the sheath.

of the incision depends on the breadth of the instrument, and is therefore a result more of mechanical arrangement than of the intelligence and skill of the operator. As in the gorget, its incision is the fruit of well-considered pre-arrangement, not of the surgeon's judgment exercised at the moment. The bistourie cachée, and the cutting gorget, different as they are

in appearance, and in the manner of their employment, are essentially the same in principle; the gorget cutting the desired depth inwards by pressure, the lithotome cutting it outwards by traction. Only the gorget, owing to its tapered form, cuts rather less deeply at the internal extremity of the incision than at the outer, while the lithotome cuts accurately to the same depth throughout, and consequently incises rather deeply the neck of the bladder, a fact of no small importance, and rendering, in my opinion, the gorget much the safer instrument of the two. Blunt gorgets, that is, gorgets which have no pretensions to cut, are rather directors than gorgets in the sense in which we have been considering them. They are intended to dilate an *already-divided* prostate, and to furnish a safe guide to the forceps in certain cases. It was in this light that Cheselden viewed the instrument.

Now, with respect to the choice which may be exercised among these methods of making the last incisions, there is a certain ease and simplicity in the use of a single knife, the sharp-pointed scalpel, which has commended it greatly to modern surgeons, and, unless there are some exceptional circumstances present, it must be admitted to be both a safe and convenient instrument. It was always used by Liston, and has been employed at University College Hospital by Mr. Erichsen and his colleagues since. Mr. Fergusson also always employs it.

But, on the other hand, there are circumstances, and by no means unfrequent ones too, in which I believe the probe-pointed knife is superior. When the stone is large, and the deep incision must therefore correspond to it, the latter is then a safer instrument, since its point leaves the staff in that act. When the perineum is deep, as in very stout subjects, and in those suffering from enlarged prostate, so that the finger cannot follow the knife as far as to the neck of the bladder, I decidedly prefer the probe-pointed knife for the last incision, as well as the blunt gorget to dilate it, and conduct the forceps into the bladder. I adopted this method with advantage in the case of a gentleman aged 69, in November last, whose prostate was unusually large. I incised it with the probe-

pointed knife, and finding myself wholly unable to reach the bladder with the finger, I passed the blunt gorget steadily onwards in the groove of the staff, and then the forceps in its hollow, when I at once encountered and withdrew the stone without difficulty. The patient made a good recovery. (See Chapter XII., Case No. 14.) This has not been the only case in which I have found the blunt gorget extremely useful.]

There is one more important point to be noticed in relation to the last incision. It is its want of exact parallelism with the external incision. The surgeon is often advised by authors to take care that the plane of the incision at the neck of the bladder should be identical with that of the external wound. Practically, it never is, and rarely can be so; and it is unwise and mischievous to conceal the fact. A glance at the diagram (fig. 35) will

FIG. 35.

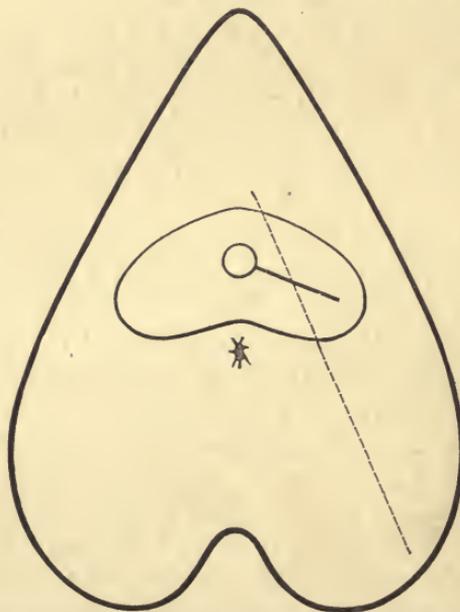


Fig 35. Superficial and deep incision in Lateral Lithotomy. The former is represented by a dotted line: the latter by a black line.

show the difference between the direction of the two incisions. Neither is there the evil in this want of parallelism which might at first appear to exist, in respect of the withdrawal of the stone; while the nearer approach to the horizontal line in the last incision, as compared with the first, is, unquestionably, an element of safety. The incision, indeed, was nearly if not quite a horizontal one with most of the best lithotomists of the last generation, whether using the knife or the gorget; sometimes, indeed, with the latter instrument, it inclined upwards. And it is necessary to recollect that if the incision in the prostate be made in the same direction as that of the skin, the limits of the gland would be much more easily exceeded. The line of safety through the prostate and neck of the bladder, whether we regard the distance of its enveloping capsule from the staff, or the situation of the seminal ducts, is a slightly-oblique line, directed rather nearer to the horizontal than to the perpendicular. And, inasmuch as all such incisions, whether internal or external, produce in the tissues openings more or less oval in form, there is far less want of correspondence in the axis of the entire wound throughout than is generally, or might be theoretically, supposed. The finger passing through a wound so made, if it be cleanly and neatly incised, detects no want of parallelism, but a clear circular passage throughout. It is quite an error to suppose that want of parallelism between an internal and external opening in soft tissues, to which a considerable amount of dilatation is to be applied, materially effects the form or capacity of the route.

III. The forceps being now in the bladder, one blade below on the floor, the other above, the instrument is opened freely and fairly; and as the remainder of the

urine flows out, it is probable that the stone will be found between them on closing; if not, they are to be kept closed and slightly moved right and left, to ascertain on which side the stone lies. Supposing it can be felt lying on the outer side of the blades, which still occupy the position first described, the upper blade is raised, by simply depressing the lower handle, and when pretty widely separated, they are slowly turned over to that side and closed, when the stone will almost certainly be felt within the grasp of the instrument. If so, and the withdrawal feels easy, it is made at once, first rotating a little the forceps on its own axis, to make sure that nothing else is included but the stone. If the angle of the handles indicates that the blades are wide apart, the point of the forefinger should be slid along the instrument to ascertain the size and position of the stone, and to readjust the latter if necessary. The long axis of the stone should correspond with that of the forceps, and its narrowest diameter should be presented to the blades. If the operator fails to seize the stone, he must still proceed cautiously, and avoid all rapid, plunging, ill-judged and uncertain movements of the instrument in the cavity of the bladder. And when the stone is fairly seized, the extraction must be slowly and cautiously accomplished; the greatest amount of dilatation of the neck of the bladder and prostate has generally now to be made, and it is more than ever necessary to the patient's welfare, that it be done slowly and judiciously. The forceps must be held so firmly as to secure the stone, but not be grasped so as to crush it. They should be slowly moved from side to side while steady traction is made in the direction of the wound, and consequently in a line obliquely downwards towards the

operator's right side. It is quite impossible to over-estimate the importance of slow and cautious action in this stage of the proceeding.

The stone removed, a searcher should be passed into the bladder and a gentle exploration made, to ascertain whether others exist. The calculus itself may be examined for facets on its surface, which are almost always, but not invariably, indications that it was not the only calculus present. On the other hand, the absence of facets is by no means absolute proof that no other stones are in the bladder. If one or more are found, their extraction must be made by the methods already described, taking care not to injure the bladder by haste or violence, which is now the main evil to be feared.

If the stone is found to be unduly large, so that, although grasped in the most favourable position for extraction which its form admits, the divergence of the blades proves to be too great, or is obviously so, for extraction through the wound, one of two courses, at least, remains to be adopted; either to enlarge the wound, or, to crush the stone, *in situ*. These alternatives, however, are rarely presented. Stones weighing nine ounces, and entire, have been successfully removed by the single incision. Crushing *in situ*, with an empty bladder contracting on the calculus, is a dangerous expedient. Nevertheless, when the stone is too large to remove by any wound which it is prudent to make, this course has been of late years usually adopted. It has been successful with a stone weighing upwards of 14 ounces. See discussion of the subject in Chapter VI., on the Difficulties and Dangers met with in Lithotomy.

IV. The Hæmorrhage, which should be watched through-

out, is now to be specially regarded before anything else is done. If an arterial jet is seen within reach, a ligature is to be placed on it; if arterial bleeding is taking place freely from a deep part of the wound, its source must be carefully sought, and ligatured if possible. If the ligature cannot be applied in the usual manner, it may, perhaps, be passed beneath by means of a curved needle, and the current stopped by a knot made upon the bleeding point. A safe and efficient mode, when the difficulty is great, is to use a tenaculum of the common form, but connected with its handle by means of a screw, so that the handle can be detached at pleasure: the hook of the instrument is passed under the mouth of the vessel, a noose of thread or silk is thrown round the soft parts beneath and tied; the handle is then unscrewed, and the hook left in its place. I believe I have saved a life on one if not two occasions by tying in the tenaculum.*

Of similar service, doubtless, is a contrivance by Dr. Gross, which he calls "the compressing forceps." It consists of blades resembling those of a pair of slender dressing forceps, but with a screw combining the handles, so that any bleeding point when laid hold of can be compressed by turning the screw; the instrument is then left in place.†

When this cannot be accomplished, and the pressure of a finger on the bleeding point itself, or on the pudic artery, commands the hæmorrhage, a trustworthy assistant or two

* I am indebted to Dr. Keith, of Aberdeen, for the tenaculum with the screw (fig. 18, p. 22), which adds much to its convenience. In the cases referred to in the text, the handle was immovable, and was much in the way; in one instance the instrument remained ten days in the wound, coming away by itself at the end of that time.

† Urinary Organs, by Dr. Gross, 2nd ed., p. 576.

may be employed to keep up such compression for a few hours, at the end of which time, if it has been steadily and unremittingly applied, the object will have been secured. In the absence of such means, and where all other methods have failed, a ligature placed round the pudic artery as it lies under the ischio-pubic ramus has been found successful. It may be accomplished in the following manner:—a stout needle curved towards the point, and carrying a strong silk thread, is introduced through the soft structures which lie on the ramus, close to the bone at its anterior border, and brought out again about three-quarters of an inch deeper in, so as to pass under the pubic trunk, the two ends are tightly tied, and if properly done, the closure of the vessel must be the result. The cessation of the bleeding will show that it has been accomplished. When there is troublesome hæmorrhage in the upper angle of the wound, where it may arise from a wound of the bulb itself, or from the artery thereto, but especially in the former case, the flow may be stopped by external pressure, using a common cork, or a portion of one, as a pad, and maintaining it in place by means of plaister and a bandage. But if the hæmorrhage is venous, the blood being dark in colour, flowing freely, but not in jets, it arises most probably from some of the veins about the apex of the prostate which have been divided. This is sometimes a difficult matter to control. Ordinary plugging of the wound with lint or sponge is very inefficient, and may rather mask the occurrence of bleeding than prevent it, by confining the blood to the cavity of the bladder. A more efficient method is the employment of an addition to the ordinary tube generally introduced after

the operation, to convey away the urine. This consists in fastening round the tube, about an inch from the end, a piece of strong but soft muslin, or fine linen, arranged, if I may use such a simile, like a petticoat, reaching to the opposite end. The material is to be plaited in a few folds there, to give room or "fulness," so that after the instrument has been introduced into the bladder, strips of lint may be tightly packed into the cavity around the tube between it and the enveloping material described (fig. 17, p. 22). In this manner the most perfect plugging of the wound in its whole length may be accomplished.

When much general oozing from the surface takes place, without any obvious single source, the application of cold by means of bladders containing ice to the perineum and hypogastrium is extremely useful; they may be applied as auxiliaries in venous bleeding also. Injecting cold water into the wound is sometimes serviceable. Irrigation with iced water is another valuable means of using cold, and is applicable to most cases. It may be accomplished by means of a reservoir of water containing ice, suspended above the bed. Two or three pieces of cotton-wick, or lamp-cotton, one end of each being placed in the water, the opposite ends reaching the patient, will carry a gentle current to the perineum and groins. Provision is made for the issue of the water on some water-proof material, to a vessel to receive it below. In all cases it is necessary to husband the resources of the patient as much as possible; hence, no free bleeding of any kind should ever be suffered to remain unchecked. At the same time, the medical treatment of hæmorrhage, which need not be described here,

using especially small doses of opium, may in some cases be extremely serviceable.

Supposing now that hæmorrhage has not taken place, or that it has been stopped, it is usual to introduce into the bladder a gum elastic tube about six or seven inches long, to prevent the inner portion of the wound becoming stopped by clot or otherwise, and producing retention of urine. The tube is fastened by tapes to a bandage round the patient's middle; but care must be taken that the end of the tube does not project far into the cavity of the bladder and become a source of irritation there.

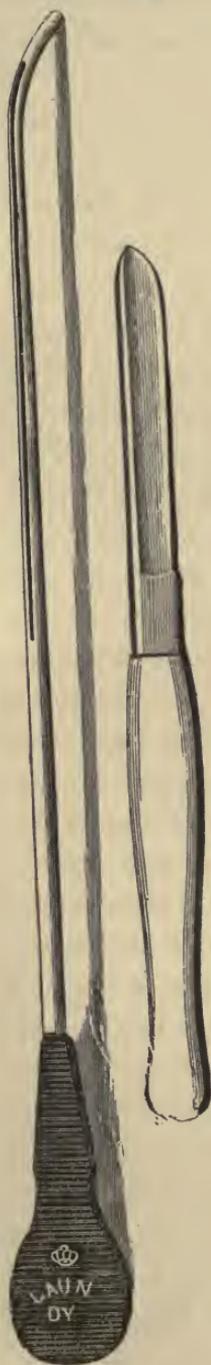
AFTER TREATMENT.—The patient is next to be put to bed. This should be a firm well-made mattrass, guarded by waterproof cloth. A dry and warm draw-sheet is to be placed beneath his buttocks, so that the wound and all that issues from it is clearly visible. On this account it is desirable that the window of the apartment should face the foot of the bed. Each lower limb is to be semiflexed at the knee, and repose easily, inclining outwards on a pillow. The attendant will watch sedulously the flow of urine and the oozing of blood during the first twenty-four hours; if the tube appears to be blocked, a soft feather must be passed through its entire length to ensure freedom of passage. What he desires and expects to see is the outflow of clear unstained urine before the end of that period; which demonstrates the cessation of hæmorrhage and the proper action of the kidneys. Opium may be administered, and in a full dose, if there is much pain, spasm, or restlessness; but it is far better to do without it, unless manifestly wanted. I cannot coincide with the conventional practice of giving thirty to forty minims of tinctura opii, or Battley's liquor, simply because a formidable operation has

been submitted to, since in many constitutions it deranges the stomach and liver, constipates the bowels, and injures the capacity for taking or digesting nutriment. Cleanliness is of the greatest importance: the draw-sheets must be very frequently changed; the nates are to be kept clean by the occasional application of a soft moist sponge, and all sources of impurity are to be speedily removed. A clean napkin, folded several times, should be placed every hour, beneath the end of the tube, and subsequently to its withdrawal, in the same situation, to absorb the urine. Mild, unstimulating diet, chiefly in the fluid form, such as milk and animal broths, should be freely afforded at first, until the stomach desires solid food, which may then at once be given. There should be no unnecessary haste to give aperients; and three or four days may well elapse after the operation without any anxieties on that head. I have seen much mischievous irritation of the pelvic viscera set up by a purgative dose, for which no real occasion existed. Supposing there has been no tendency to bleed, the tube may be withdrawn in twenty-four, thirty-six, or forty-eight hours; if otherwise, it may be retained rather than risk disturbance to the parts for three, four, or even five days; but this is quite exceptional. As the case progresses, care must be taken, especially with elderly patients, to avoid irritation of the skin of the back and buttocks, which, if neglected, might produce bed sores. The surface is to be defended from the contact of urine by the free use of common ointment, and hardened by the occasional use of astringent lotion, or by simple brandy-and-water. A proper position of the patient is by no means unimportant as favouring the desired result; the head, shoulders, and upper part of the trunk, should be kept rather high, so that

the wound is placed as much in a depending position as circumstances admit. In this manner the urine, and other discharges, are better removed.

After the first twenty-four hours the edges of the wound being a little swollen, urine frequently passes two or three times by the urethra ; after twenty-four or thirty-six hours more it passes entirely through the wound. Subsequently, it may be expected, in the cases of adults, to pass in part through the urethra, by about the eighth to the twelfth day ; and to cease issuing through the wound in about three weeks after operation. There is much difference, however, in this matter ; many weeks elapsing in some instances before the final healing of the perineal wound, which, indeed, in some few instances remains permanently fistulous ; while in others healing really occurs by first intention. It would be unjust to the memory of Mr. Crichton to pass over the last-named circumstance without remark. It was a favourite subject with him ; nevertheless, it appears to me difficult to regard it as one of great importance. He records thirty examples of it as occurring in his practice, a proportion which is extremely large. Of the cases presented to him, he selected the most healthy and vigorous for whom to attain this result ; making his incisions free and clean, so as to offer surfaces adapted to unite readily. No tube was passed through the wound afterwards ; a piece of wet lint was applied to it, and the legs fastened together. Occasionally retention of urine occurred, with a good deal of pain, in which case the patient was put into a hot hip bath, which was a favourite remedy with him in all cases of severe abdominal pain arising within twenty-four or thirty-six hours of the operation. But if the stone was large, and had been difficult to extract, or if the patient was feeble, he generally employed the tube, and

FIG. 36. FIG. 37.



made no attempt at early union. It is remarkable how different are the opinions of operators as to the value of the tube. While some believe it to be a *sine quâ non* to success, others attach no importance to it. That it can prevent access of urine to the newly-cut surfaces, as has been written concerning it, no one can seriously imagine after reflection, and certainly not after observation, since urine may be constantly found trickling by its side, as well as through it. It is undoubtedly a guarantee against retention, and may be made very useful against hæmorrhage, but it is also sometimes a source of irritation to the bladder, and I have seen a patient greatly relieved by its early removal.

For the various accidents accompanying and following the operation, as well as the difficulties and dangers sometimes encountered in its performance, see Chapter VI.

KEY'S OPERATION ON THE STRAIGHT STAFF.—The operation performed on a straight staff by Mr. Aston Key merits description here, as a modification of the ordinary lateral operation, the consideration of which is now concluded. Mr. Key's operation finds favour with many of his former pupils; and is still

Figs. 36, 37. Key's knife and staff, from his work, plate iv.

preferred by them, as it was by that able surgeon himself to the end of his career. The mode of performing it is given here in his own words, which clearly delineate the method he adopted, and which is followed at the present day by the surgeons of Guy's Hospital.

“The mode of conducting the operation is as follows:— An assistant holding the director,” (or straight staff,) “with the handle somewhat inclined towards the operator, the external incision of the usual extent is made with the knife, until the groove is opened, and the point of the knife rests fairly in the director, which can be readily ascertained by the sensation communicated; the point being kept steadily against the groove, the operator with his left hand takes the handle of the director, and lowers it till he brings the handle to the elevation described in Pl. III.,” (that is, until the sound makes an angle with the horizon of about thirty degrees,) “keeping his right hand fixed; then, with an easy simultaneous movement of both hands, the groove of the director and the edge of the knife are to be turned obliquely towards the patient's left side; the knife having the proper bearing is now ready for the section of the prostate; at this time the operator should look to the exact line the director takes, in order to carry the knife safely and slowly along the groove; which may now be done without any risk of the point slipping out. The knife may then be either withdrawn along the director, or the parts further dilated according to the circumstances I have adverted to. Having delivered his knife to the assistant, the operator takes the staff in his right hand, and passing the forefinger of his left along the director through the opening in the prostate, withdraws the director, and, exchanging it for the forceps, passes the latter upon his finger into the cavity of the bladder.

“In extracting the calculus, should the aperture in the prostate prove too small, and a great degree of violence be required to make it pass through the opening, it is advisable always to dilate with the knife, rather than expose the patient to the inevitable danger consequent upon laceration.” *

* Treatise on the Section of the Prostate Gland in Lithotomy. By C. Aston Key. Lond. 1824. Pp. 28-30.

CHAPTER III.

THE OPERATIONS OF LITHOTOMY PERFORMED IN THE CENTRAL PORTION OF THE PERINEUM.

Numerous Attempts made to improve on Lateral Lithotomy.—The Bilateral Operation of Dupuytren.—The Medio-bilateral.—The Median.—Dr. Buchanan's Method.—The Recto-vesical Operation.—Modifications.—Cutting and Crushing combined.—Lithotomy as applied to Children.

THE preceding chapter has been devoted to the Lateral Operation, in order to describe it fully, because many of the minute details of management are common to it and to other forms of Lithotomy, and are therefore given once for all; and because it may fairly be regarded as the standard with which such other modes of operating, next to engage our attention, should be compared.

For the problem has been presented for years, and is still presented to us with increasing force :

Is the Lateral Operation the best mode, in all cases, of extracting, through the perineal region, a calculus from the bladder ?

That its results have not satisfied the expectations, or, at all events, the wishes of many surgeons, is evinced by the numerous efforts which have been made from time to time, by the most experienced operators, to discover a better method. Witness the Recto-vesical Operation of Hoffman, Sanson, and Vacca—the Bilateral of Dupuytren—the

Medio-bilateral of Civiale; and the Median of the Italian surgeons, with that form of it so well advocated here by Mr. Allarton, to say nothing of the endless lesser modifications which have been many times proposed, forgotten, and reproduced.

One thing strikes a careful observer; it is that all the other operations which have at any time held a position, or are holding one in the surgical world, are essentially operations performed in the centre of the perineum, and not on either side, or lateral division of it. All are central in the sense in which it is opposed to *Lateral*.

True, one is called Bilateral, but we shall soon find that it possesses characters which refer it distinctly to the central group.

During the last fifty years especially, there has been a growing conviction that incisions made in the side of the perineum are attended by serious dangers, which may be avoided by incisions limited to the centre.

First, it has been believed that severe hæmorrhage is less likely to follow incisions in the centre than in the lateral division of the perineum, because the great vessels lie in this latter portion, provided further that the median incisions do not much involve the bulb.

Secondly, it has been believed that the capsule of the prostate is less likely to be divided, and consequently that the cellular interspaces between the pelvic viscera are less likely to be opened by incisions in the centre than on one side only of the perineum.

Unquestionably, it must be agreed by all that the anatomical necessities of the region, if alone considered, demand that, in the preliminary incisions of all Perineal Lithotomy, central or lateral, the operator should avoid the

upper and outer parts of the perineal space, and that he should confine the deep ones within the limits of the prostate gland. But there is another necessity, not an anatomical but a vital one, less obvious, possibly, to the casual observer, but not a whit less urgent, and with which the former must be reconciled, viz. :—the important fact that the internal opening must be sufficiently free to admit the instrument and the stone to pass without the exercise of so much force as to hazard the destruction of the tissues at or about the neck of the bladder. It is the clashing of these two opposed considerations, the vital and the anatomical, which will, probably, always maintain a difference of opinion and of practice in Lithotomy. One school will be most influenced by the dangers to which Anatomy demands attention. Another school will be most impressed with the injury which the tissues suffer when incisions have been unnecessarily limited. The difficulty is to reconcile them ; to find precisely the safe medium of action. It must vary in different cases ; and the knowledge and the judgment of the operator must decide the question in each.

It was under the influence of anatomical considerations that Dupuytren was led to devise his Bilateral Operation. To avoid the arterial branches springing from the great trunk of the pudic on the lateral boundary ; to avoid the bulb above and the rectum below ; to avoid by two minor incisions springing from the central axis any division of the prostatic capsule by the single large incision directed to one side, he planned the following procedure, and first performed it in 1824.

DUPUYTREN'S BILATERAL OPERATION.—Having introduced a staff with a median groove, he made a crescentic

incision above the anus with the horns of the crescent downwards. Each extremity reached midway between the anus and the adjacent tuber ischii, and the middle or highest point was distant from the anus about ten or twelve lines. By this incision were divided the skin, the superficial fascia, and a little of the external sphincter. In the next, the membranous urethra was opened transversely, and sufficiently to admit the operator to introduce the end of a two-bladed lithotome into the groove of the staff. This was pushed onwards into the bladder, the stone felt with it, and the staff removed; the blades being then opened to an extent previously provided for, they were steadily withdrawn in the middle line and in the horizontal plane. By this means an incision nearly transverse, but also somewhat obliquely downwards, was made of the neck of the bladder, and into each lateral lobe of the prostate. In a few years afterwards some slight modifications of this proceeding were made by various operators, but they possess only historical interest, and have no practical value. See fig. 39 for a diagram of the incision superficial and deep. Fig. 38 shows the two-bladed lithotome which he employed.

THE MEDIO-BILATERAL.—We next

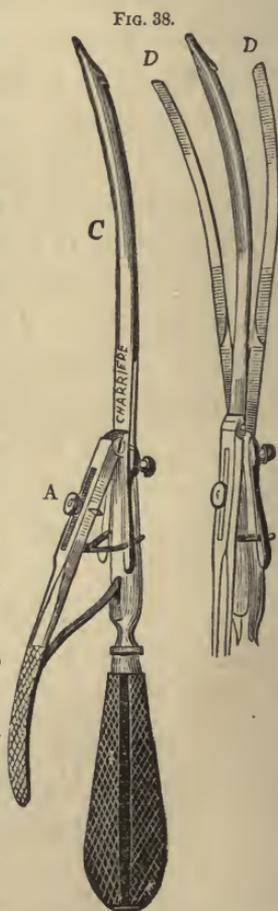


Fig. 38. The double-bladed lithotome, for the bilateral and medio-bilateral operations. A, the screw which regulates the extent to which the blades open. C, the sheath with the blades enclosed. D, D, the blades opened.

FIG. 39.

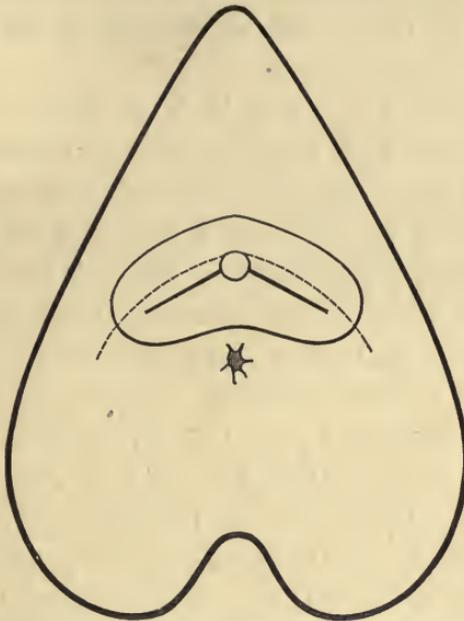


Fig. 39. Diagram of superficial and deep incisions in Bilateral Lithotomy. The former is represented by a dotted line, the latter by a black line.

come to a method which Civiale describes in his "Parallèle,"* published in 1836. "Being dissatisfied," he says, "with the results of the bilateral operation, and shunning the lateral method on account of the anatomical objections referred to," he first practised a medio-bilateral method in 1829, and has performed it ever since. It is remarkable that this operation, although now upwards of thirty years old, appears to be unknown in this country. I believe it has never been even described here, which is still more remarkable, considering its near relationship to the median operation, and the fact that this has been so much discussed here of late years. I have myself witnessed the successful performance of it in its author's hands, and have been, I believe, the first to

* *Parallèle des Divers Moyens, &c.* Paris, 1836. Pp. 192 and 217.

perform it in this country, in a case which occurred during the autumn of 1861, and which shall be briefly related among the illustrative cases.

Civiale's method of doing it is as follows:—Having introduced a staff with a median groove, which is firmly held resting against the pubes by an assistant, he makes an incision about an inch and a half long in the raphé of the perineum, immediately in front of the anus, and carefully cuts down in the direction of the staff, endeavouring to avoid the bulb, until he reaches the membranous portion of the urethra. He then carries his knife into the staff in that situation by an incision sufficiently large to enable him to insert with ease the end of a double-bladed lithotome, resembling that of Dupuytren, but straight instead of curved, into the groove of the staff. He then slides the beak of the lithotome steadily onwards into the bladder, and having done so, draws it outwards in the groove, towards himself, dividing the neck and the prostate horizontally, as well as the deep fascia in its course. The external wound is oval in form, a vertical incision in the perineum always becoming so; hence the skin is not cut transversely by the lithotome in the act of withdrawal. The finger is now introduced, and the forceps upon or guided by it, in the usual way; the external and internal openings are felt to correspond, and to form an easy and direct route for the removal of the stone. I have seen Civiale remove a stone weighing one and a half ounce by this method, the patient, a man forty-five years of age, making a good recovery. The breadth of the internal or horizontal incision is less than in Dupuytren's operation, in which the two blades of his lithotome were extended so as to be one and a quarter to one and a half inch apart. Civiale

advises that they should ordinarily be one inch apart, and never or very rarely more than an inch and a quarter (fig. 40).

FIG. 40.

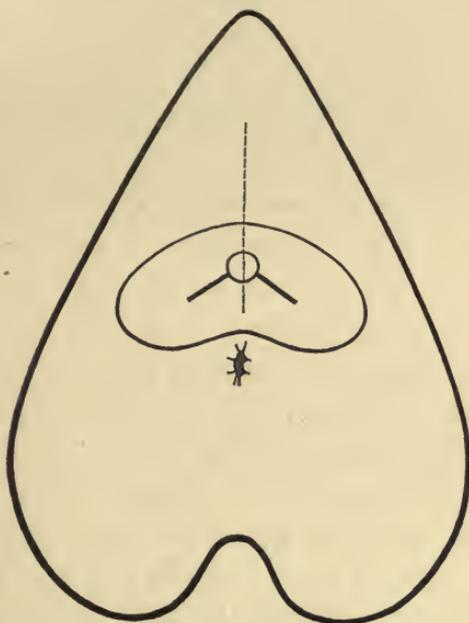


Fig. 40. Incisions superficial and deep in the Medio-bilateral Operation.

The case in which I performed this operation was that of a patient forty-five years of age, who had suffered with stone about three years. He was recommended to me by my friend Mr. Cooper, of Canterbury, but not regarding it as suitable for Lithotrity for reasons which I need not particularize here (see Chap. XII., Case 13), I decided to cut him on the above method, my colleague, Mr. Erichsen, holding the staff. The patient made an excellent and rapid recovery, although a small fistule remained in the track of the wound for some time. In the course of the following week, Mr. Erichsen had a case, in which he adopted the same method and instrument, and on that occasion I

held the staff for him. It was that of a gentleman above sixty years of age, who had three moderate-sized calculi in his bladder; and the operator considered the opening made to be satisfactory in every respect. It should be stated, that in the last edition of his well-known work, Mr. Erichsen has suggested precisely this mode of operating as an improvement on the median, although he had not at that time put it in practice.*

MEDIAN OPERATION.—The Italian or median method, known here as Allarton's operation, is the next in order to be described. The operator having placed a staff with a median groove in the bladder, and entrusted it to an assistant to maintain strictly in the middle line, and resting closely on the pubic symphysis, places his left forefinger in the rectum, with its palmar surface upwards, to determine the apex of the prostate, placing the point of his finger upon it. Next, he transfixes with a long and straight bistoury, the cutting edge of which is directed upwards, the integuments of the perineum, in the median line, commencing about half an inch anterior to the anus, and carries it steadily onwards until it enters the groove in the staff, and pierces the urethra about the membranous portion, the finger in the bowel rendering this manœuvre tolerably easy. Having pushed the point of the knife, which should cut for a small space at the back, onwards towards the bladder for the extent of a few lines, so as just to incise the apex of the prostate, he cuts upwards, dividing the urethra a little, and making an external incision from an inch and a quarter to an inch and a half long, according to the presumed necessities of the case. He then introduces a long ball-pointed probe through the wound into the bladder to serve as a

* Art and Science of Surgery. 3rd Edit., Lond. p. 1020.

FIG. 41.

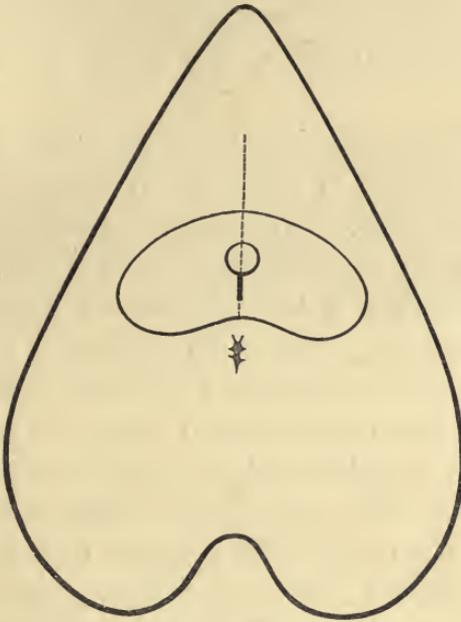


Fig. 41. Incisions in the Median Operation.

guide for the left index finger, which immediately follows directly into the bladder, and the staff is at the same time withdrawn. The stone may now be felt, and the wound dilated by means of the finger. Mr. Allarton has recommended, if the finger be insufficient for the purpose, the use of Dr. Arnott's hydraulic dilator; and Mr. Teale, of Leeds, has designed and employed a branched metallic dilator. I cannot, however, concur in advising the employment of mechanical force in dilating the structures forming the neck of the bladder, believing it far safer to make an additional section when necessary. Respecting the modes of making the incisions, I prefer dissecting from the skin inwards to the staff as in other operations, to the method by transfixion above described, and have done so in my three latest

operations by the median method: maintaining the left forefinger in the rectum during the final strokes of the knife to feel its position, and insure the safety of the bowel.

The incisions here described differ little from those of the Marian, except in being carried further back than in the ancient method, and hence leaving a shorter portion of the urethra, the prostatic only, to be dilated. As before noticed the danger of the Marian arose from the practice of forcibly rending asunder the urethra and neck of the bladder, a proceeding infinitely more fatal than division by the knife, which the anatomical theory, so greatly in the ascendant at that time, had, unhappily, proscribed.

Of all the cutting operations for stone, it is unquestionable that the median still presents that in which the bladder is reached with the smallest amount of section by the knife. And it appears to become dangerous, just in proportion as injury by laceration or over-pressure, under the name of dilatation, is superadded to the incisions. These latter involve the bulb to a small degree, which is the only structure of importance divided by the knife besides the prostate, and this latter is only slightly notched at the apex in the ordinary mode of performing the operation. But when the deeper parts of the wound feel more than usually rigid and unyielding, or when the stone proves to be larger than was anticipated, it is advisable to make an incision in the left side in the same direction as in Lateral Lithotomy, but generally less extended, for the purpose of affording more space. This is accomplished after the urethra has been opened, by introducing a long straight, probe-pointed bistoury, guided by the left index finger, and made to incise as much as the operator deems

necessary. Unless this or some similar proceeding be adopted the opening is certainly small, and feels tight to the finger, and, if the stone is large, appears to me to require an additional incision.

After all, the anatomical axiom laid down at first must not be forgotten, viz. that any operation, the incisions of which lie altogether in the line above the anus and below the symphysis pubes, unless aided by a lateral section, never can afford an opening sufficiently capacious for the removal of very large stones without dangerous laceration. Examine the pelvic outlet, and contrast the want of space in this situation caused by the converging pubic rami, with the room which exists in one of its lateral divisions, and the correctness of this assertion will, I think, be manifest.

BUCHANAN'S OPERATION.—The Operation of Dr. Buchanan with the Angular Staff. This proceeding, generally known as the operation with the angular staff, is, however, not rendered distinctive solely by the use of that instrument. The angular staff does not constitute the main element which characterizes it from other proceedings, although it is one of its features, and perhaps, at first sight, its most obvious one. Thus it is that this character has taken hold of the public mind, and, by its prominence, has somewhat concealed the more important attributes of the operation. It is essentially a central operation, but with a freer internal opening than is provided in the median. The angular staff constitutes merely a safe and efficient guide to the deep part to be incised, viz. the membranous urethra and apex of the prostate. Such a staff has been used a century or more ago in the lateral operation, a fact which detracts nothing from any merit which may attach to the present procedure.

Actuated by his conviction of the anatomical dangers of Lateral Lithotomy, Dr. Buchanan, of Glasgow, called attention, in 1847, to the advantages of operating in the central part of the perineum instead of the lateral, and of employing a staff of rectangular form, on which to make the necessary incisions. It is somewhat remarkable that his method has never been yet correctly described in our language, and I am indebted to Dr. Buchanan for a description in French, which he informs me is the most accurate now existing. I must confess that until I became acquainted with the latter I had not a correct idea of the proceeding. It may be briefly described as follows:—

Instead of possessing any curve, the terminal portion of the staff, three inches in length, is directed at a right angle to the shaft, and contains a deep lateral groove. This is introduced into the urethra, and by means of the left forefinger in the rectum the angle is made to correspond in situation with the apex of the prostate, so that the gland can be felt just beyond, between the finger and the staff; the latter being well depressed, the angle is brought near to the surface, and is readily felt in the perineum. The staff is then carefully maintained in this position by an assistant. The operator keeping his finger still in the rectum, enters a long straight bistoury opposite the angle of the staff, and therefore immediately in front of the anus: he holds it in his right hand, with the palm upwards; the blade horizontal and its edge directed to the left; and he pushes it straight into and along the groove as far as to the stop at its extremity. He thus enters the bladder at once, taking care to keep the blade parallel with the horizontal or grooved portion of the staff throughout the whole of the thrust. Next he withdraws the bistoury

FIG. 42.

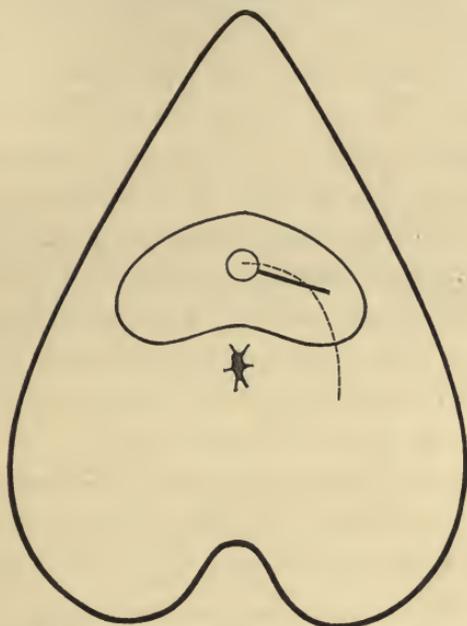


Fig. 42. Incisions superficial and deep in Dr. Buchanan's Operation.

slowly, but, as he does so, cuts outwards and downwards a distance rather more than equal to another breadth of his blade, and then directly downwards to the same extent, describing, in this manner, a curved line equal to about one-fourth of a circle round the upper and left side of the rectum (patient's left), in which his finger still remains. An external wound, surrounding the corresponding part of the anus, about one inch and a quarter in length, results from the operation. The knife is a long straight bistoury, about a quarter of an inch wide, with three inches of cutting edge, and the point sharp at the back as well as at the front, so as to penetrate with facility.

This is essentially a median operation, all large arterial branches in the lateral part being avoided, while the bulb

is not cut, but the left half of the prostate is incised to a small extent.

Thus far it is, as expressed by Dr. Buchanan himself, about equal to the half of Dupuytren's Operation. If the stone is large, an incision is made on the right side of the prostate, which has the effect of converting the proceeding very nearly into the operation referred to. But it is also capable of being extended in another way, since if the incision by the side of the rectum and through the prostate be continued much beyond the extent described by its author, in the original direction, it becomes a lateral operation placed very low in the pelvic outlet.*

THE RECTO-VESICAL OPERATION.—The patient is placed in the usual position, and a large staff with a median groove held firmly in the middle line. Taking a strong, straight,

* Dr. Corbet, of Glasgow, has added an external grooved director connected with the handle of this staff; after the introduction of the latter into the bladder, the point of the director has only to be pressed through the tissues into the angle of the staff, which it infallibly meets, and a route for the knife is made from the skin of the perineum to the bladder. (*Medical Times*, Dec. 16, 1858.) Sir James Earle adopted the same system for Lateral Lithotomy. See a descriptive plate in his "Practical Observations," 2nd Edition, London, 1803. Mr. Avery contrived a very ingenious apparatus by which a director was *forced outwards* by mechanism from the angle of the staff after the latter had been securely placed in the bladder; when the point of the issuing director had made its appearance through the skin, the operator commenced to travel along its route into the bladder. It may not be inappropriate to mention that Mr. John Wood, of King's College Hospital, has designed and employed a staff, the lower part of which consists of two blades, which, at the will of the operator, may be made to expand a little in order to stretch the urethra and afford a wider groove for the knife.

I hope I am not presumptuous in venturing to regard—I believe in common with many practised lithotomists—all these contrivances as entitled to rank rather among the curiosities of surgical appliance than as valuable aids to the operator. Elaborate mechanism cannot countervail the want of surgical tact. Where the latter exists, such aid is worse than useless. "Tactus eruditus," the priceless and incommunicable heritage of experience, can only be acquired by the use of simple instruments; by discarding complicated apparatus for all those purposes which can be attained by that most wonderful and intelligent instrument, the human hand.

sharp-pointed bistoury in his right hand, the operator introduces it flat on the palmar surface of his left forefinger into the rectum, and feels with its tip the line of the staff. When about an inch and a half or an inch and three-quarters of the blade are concealed within the bowel, with the right hand he raises its edge, and carries the knife upwards to the groove in the staff, propelling the blade at the same time with the left forefinger. He thus divides, at this first incision, the upper wall of the rectum, the sphincter ani, and the integuments and subjacent tissues for about an inch in the middle line of the perineum. He should reach the groove of the staff in this first incision, and having done so, he next directs the nail of the left forefinger, so as to enter the groove near to the membranous urethra, and guide the point of the bistoury into it there, the edge being now downwards. Having securely placed it in the groove, he pushes the blade from him along the staff, directed by the left forefinger, dividing the prostate and neck of the bladder so as to reach the trigone. The exact extent of this incision must depend on the size of the stone, and, as it may be presumed that this method should be employed only when the stone is unusually large, the incisions must of course be free. In no case, however, is it permissible to place in danger the peritoneal pouch, which limits the posterior border of the trigone. The finger can now easily examine the stone and guide the forceps in the extraction. The wound is favourably placed as an outlet for all discharges, and no hæmorrhage need be feared.

There are some variations in the manner of performing this operation, but the foregoing is the mode which has generally been regarded as the most successful, and the

most likely to be free from disagreeable after consequences.

Such are the methods of performing Perineal Lithotomy, which, after a careful consideration of the numerous proposals and modifications which have been made and practised, I have concluded to be the typical forms which are or have been employed in modern times. Numerous others might have been mentioned with which the names of several surgeons are connected, and who possibly may regard my selection as incomplete. Thus it may be considered by some that I should have included among them the Prerectal method, somewhat recently introduced in Paris ; but it is difficult to admit that it possesses claims to be regarded as a new type, or, indeed, that it manifests much improvement on any old one. This, however, is a matter of opinion. The operation so named is a modification of the Bilateral, in which the curved incision and subsequent dissection are carried so close to the anus and rectum, that the first stage consists in a delicate dissection downwards of the upper surface of the rectum ; a method adopted with the design of leaving the bulb untouched. The urethra is opened at the apex of the prostate, which of then incised with the two-bladed lithotome in the ordinary manner.

Attempts have also been made to combine cutting and crushing, so as to empty the bladder at one operation. The object has been, first, to open the urethra in the perineum, anterior to the prostate : a proceeding which we know involves very little, if any, risk ; and then to introduce a crushing instrument, break up thoroughly the stone, and remove the débris at once. Theoretically this method has a better aspect than in practice. The difficulty in exe-

cutting it is due in a great measure to the escape of urine by the side of the crushing instrument, so that before the work of breaking the calculus is completed the bladder is empty; when the situation is no longer merely one of difficulty to the operator, but of danger to the patient. Much the same thing happens in Lithotomy when the stone is crushed by inadvertence in the blades of the forceps; a good deal of instrumental manipulation is requisite in order to ensure the removal of every fragment, while the bladder is in some risk of being injured, or of becoming inflamed. As in the case of applying screw forceps to a stone too large to extract after the incisions have been made in the lateral operation, the risk of danger consists in the liability of the emptied bladder to sustain severe injury.

LITHOTOMY AS APPLIED TO CHILDREN.—In considering the various methods hitherto described, the common practice has been followed of assuming an adult to be the subject of the operation in each instance. And there is little occasion to modify them for the cases of children, the same procedures being applicable, for the most part, at all ages. Nevertheless, there are certain points of importance to be attended to in the application of Lithotomy to children, which will be briefly mentioned here.

First, as to the kind of operation most generally applicable to the cases of infants and boys; the lateral is generally, and no doubt correctly, held to maintain its superiority, as a rule, over other methods. The median and the medio-bilateral are both admissible. But especially where the stone is large, the lateral operation affords the opportunity of making a freer opening, and in a direction in which the incision is less liable than that of the median

to injure the seminal ducts. At the same time, a lateral section carried beyond the limits of the prostate, which is an extremely small organ at this period of life, is almost free from danger, since it is beyond all question necessarily practised in almost all infantile cases, while the death-rate among them is not more than half what it is in adult age, when such sections are usually regarded as attended with the greatest risk.

In the performance of Lateral Lithotomy in children, the employment of one knife only is especially indicated. An exchange of the scalpel for the beaked knife exposes to some risk from the possibility of finding difficulty in the attempt to place the beak of a second knife in the opening made by the first, and thus of missing the groove of the staff altogether. The deep incision in the urethra and prostate should be made with clearness and decision, and with sufficient freedom to admit the tip of the operator's index finger with tolerable ease, otherwise he may drive the neck of the bladder along the staff, or slide the finger into the cellular interval between the bladder and the rectum. The staff should be strongly curved, and the finger and the forceps should be kept well up behind the symphysis in their transit, in consequence of the high situation of the bladder, which, in very young children, lies, when distended, as much in the abdomen as in the pelvis.

Hæmorrhage should be carefully guarded against, as its results in the shape of exhaustion are particularly dangerous in young subjects. The special sources of difficulty and danger in this operation will be considered in the sixth chapter, on the Difficulties and Dangers met with in Lithotomy; pp. 102-5.

If the median operation is performed, it is desirable to use a guide into the bladder in the shape of a blunt gorget or some similar instrument, as the operator may find it extremely difficult to introduce the finger into the small urethra of a child, when opened anterior to the prostatic or membranous portions. For this purpose I used with advantage, three or four years ago, an instrument of that kind, tapering in its contour, and having a probe point in its central axis (see Case 12, Chap. XII.). Mr. Bowman, and Mr. Teale also, about the same time, employed somewhat similar means for meeting the difficulty referred to, which each had encountered. By the use of any of these instruments the incised opening into the urethra is partly dilated and partly torn, a proceeding which appears to be attended by no evil results in children, whatever may be its effects in the adult patient. In the medio-bilateral operation, which I have witnessed on a young subject, no such guide, of course, is necessary. The two-bladed lithotome glides easily along the staff into the bladder, and forms sufficient room for the finger in its withdrawal by laterally incising the soft parts.

CHAPTER IV.

THE SUPRAPUBIC OR HIGH OPERATION.

Origin of the Operation.—Method of Performing in Detail.—Mortality of the Various Operations described.

WE now arrive at a consideration of the operations performed above the pubes, of which one is the type, known as THE HIGH OR SUPRAPUBIC OPERATION. This appears to have been designed by Pierre Franco, and was certainly first performed by him in the year 1561. It was introduced into this country by Proby, at the close of the sixteenth century, and was frequently practised afterwards in the early part of the seventeenth century by Douglas, Cheselden, and others. Subsequently, it was studied with care and frequently performed by the Souberbielles in France, while Mr. Carpue, who had witnessed their practice, advocated it in this country. There are two or three modes of performing the operation, but that which appears to me the most complete, and which Civiale informs me he has practised several times, is as follows:—

The patient is placed on a firm operating table of the usual height. He lies on his back, with the pelvis elevated at least four or five inches above the level of the loins and shoulders, so that the abdominal viscera shall not press on the bladder, but rather fall away backwards from it. The

bladder, which should be capable of retaining a tolerably large quantity of fluid, is now to be injected to a full

FIG. 43.

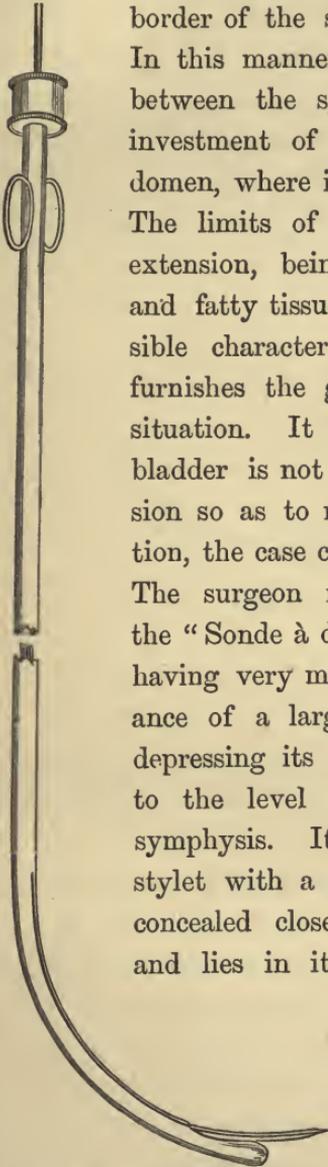


Fig. 43. The "Sonde à dard."

extent, so as to bring its apex to the upper border of the symphysis pubis, or above it. In this manner a sufficient space is obtained between the symphysis and the peritoneal investment of the anterior wall of the abdomen, where it quits it to cover the bladder.

The limits of this interval admit of great extension, being filled mainly with cellular and fatty tissues of a very loose and extensible character, and this fact it is which furnishes the ground for operating in this situation. It follows, therefore, that if the bladder is not capable of considerable distension so as to rise into the interval in question, the case cannot be regarded as suitable.

The surgeon now passes into the bladder the "Sonde à dard" (fig. 43), (an instrument having very much the form, size, and appearance of a large prostatic catheter,) and by depressing its handle raises the point nearly to the level of the upper border of the symphysis. It contains within it a strong stylet with a cutting point, which latter is concealed close to the apex of the sound, and lies in its concavity, whence it can be

made to emerge at the will of the operator. Having confided the "sonde à dard" to an assistant, he places himself on the patient's right side,

and commences the incision above the pubes, which should be from three to four inches or more in length, according to the amount of fat at this spot, and which in some subjects is very abundant. It is to be made exactly in the median line, and at its lowest point should reach the top of the pubic symphysis. The cellular tissue and fat are divided to an equal extent, until the linea alba is exposed by its characteristic glistening appearance. Placing his left index finger on this, and verifying through it the upper border of the symphysis, he divides with the scalpel the linea alba at this point, in the median line, from a quarter to three-eighths of an inch, and then introduces the bulbous extremity of the aponeurotome (fig. 44),

FIG 44.



Fig. 44. The Aponeurotome.

which by its form enables the tendinous structures to be incised without any risk to the parts beneath. The division is accomplished by directing the aponeurotome upwards to the extent of one and three-quarters to two inches. The operator now takes the "sonde à dard" from the hands of the assistant, who has hitherto held it in its place; and with the right hand depresses its handle between the thighs of the patient, directing the point to the wound above the pubes. With his left hand he seeks the end, now readily to be felt through the tissues still remaining uncut, and fixes it between the thumb, index, and middle finger, taking care while doing so to remember that it is from the concave surface that the point will be

protruded. Having rendered the instrument quite firm between his two hands, he directs the assistant to press the handle of the stylet so that the point issues from its place for two or three inches, and appears in the wound immediately above the symphysis. A communication with the bladder is thus perfectly established. The surgeon now takes an ordinary scalpel, and placing it in a groove existing for that purpose in the stylet, cuts downwards from the point of transfixion nearly to the neck of the bladder behind the symphysis. His forefinger is then applied, with its palmar surface upwards, to the top of the wound, to hook up the bladder, while the assistant withdraws the "sonde à dard," having first replaced the stylet in its sheath. An instrument called the "Gorgeret suspenseur" (fig. 45), but which we may term the hooked gorget, now

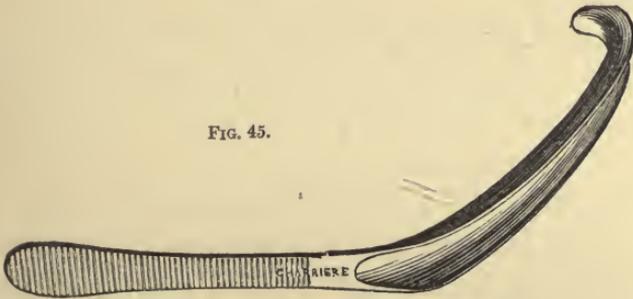


FIG. 45.

Fig. 45. The hooked Gorget, "Gorgeret suspenseur."

replaces the finger, and is committed to an assistant standing on the left side of the patient. It is very important to maintain the top of the bladder steadily in place throughout all subsequent movements, and that the peritoneum, which is quite close to the wound at this point, should be preserved from injury. The surgeon now searches the interior of the bladder with his fingers, ascertaining the position

and size of the stone, and introduces the forceps for its removal, which is generally tolerably easy, and may be effected by careful traction upwards and backwards. In a few cases with stones of extreme size the wound has been divided laterally to a small extent in order to afford additional space.

I shall conclude this chapter by a brief statement respecting the mortality, so far as it has been ascertained, which is ordinarily met with after Lithotomy by the various methods described.

From a laborious and extended inquiry into the numerical relation of deaths to cures after the lateral operation at all ages, I have arrived at the following general results; postponing, for the present, the mention of some remarkable facts arising out of it which will be fully exposed in Chapter XI.

Out of 1827 cases of Lateral Lithotomy, each one of which is known and vouched for, and the aggregate of which is undisturbed by any selection of cases for other modes of treatment, there were 229 deaths, or a total of one death in seven and a half cases, at all ages. This collection results from the united experiences of the following hospitals during certain fixed periods of time: Metropolitan: Guy's, St. Thomas', and University College Hospitals; Provincial: the hospitals of Norwich, Cambridge, Oxford, Birmingham, Leicester, and Leeds. It is, however, extremely necessary to regard the question of mortality in relation to the age of the patient, which influences so greatly the success of the operation, and to remember that no general statement of this kind conveys any real information, unless the means are also provided of ascertaining the proportion

of cases which occurs in childhood, in youth, and during middle life, and old age respectively. For these particulars, see the chapter already referred to.

To Mr. Allarton I am indebted for the record of 139 cases of Median Lithotomy at all ages, with 13 deaths, or one in 11 cases. Not to forestall future observations, it is necessary to note that this operation, being usually reserved for stones known or believed not to be very large, we are entitled to claim from it a result better than that of Lateral Lithotomy. This does not include the Norwich cases of the Median Operation, which my friend Mr. Cadge informs me amount to between forty and fifty within the last three or four years, and the mortality from which has been about the same as by the lateral method. But it is only fair to state that there was rather a full proportion of unpromising cases among them.

Dr. Buchanan is able to report upwards of sixty cases of his operation, performed by several surgeons, with, as nearly as possible, the same result as that exhibited by Mr. Allarton's table.

From the history of the Bilateral Operation, we know that in the hands of Dupuytren, and his contemporaries, 85 male cases were cut, with 19 deaths, or about one in $4\frac{1}{2}$ cases. In other hands it is said to have been more successful.

Of the Medio-bilateral Operation we possess no statistical records.

From the history of the Recto-vesical Operation, we learn that a nearly equal number of cases gave a result of about one death in five; and a similar proportion of the patients recovering were the subjects of fistula subsequently.

The Suprapubic Operation has given results said by some to be about one death in four cases. Dr. Murray Humphry, of Addenbrooke's Hospital, Cambridge, performed it successfully for a boy of fourteen years. He collected from authentic sources 104 cases, of which 31 were fatal, equal to one death in $3\frac{1}{3}$ cases. Of course it is to be recollected that this, as well as the preceding operation, is rarely performed for other than very large stones, and mostly in adults. He remarks, also, that "the dangers of the high operation do not increase in so great a ratio with the size of the stone" as in the lateral operation.*

* Case of High Operation. Trans. Prov. Med. Ass. 1850. Vol. xvii. p. 103.

CHAPTER V.

CAUSES OF DEATH FOLLOWING LITHOTOMY.

Causes of Death at different Ages must be considered separately.—Causes of Death in Adults.—Inflammation of Tissues around the Neck of the Bladder ; and its Causes : most commonly due to Violence in withdrawing the Stone.—Urinary Infiltration ; sometimes leading to Peritonitis ; from Erysipelas, &c.—Cystitis ; sometimes leading to Inflammation of the Kidneys, or of the Peritoneum.—Absorption of Poisonous Products from the Urine.—Phlebitis and Pyæmia.—Shock.—Hæmorrhage and Exhaustion.—Tetanus.—Causes of Death in Children ; why differing from the preceding.—Peritonitis : very rarely, Infiltration.—Exhaustion, &c.

WE now arrive at the important subject of the causes of death following the operation of Lithotomy. And this will be studied with advantage before coming to an appreciation of the different modes of performing it already described. A careful consideration of numerous facts leads me to take views of this question which differ somewhat from those generally held respecting it.

In the first place, it is impossible to regard the deaths following Lithotomy as a single aggregate or class, relative to which any leading particulars can universally apply. Nothing can be more deceptive than a method of dealing with the results of Lithotomy, whether numerically or otherwise, by which cases of all ages are treated indiscriminately in one category. The causes of death are not the same in adult life and in the period of youth ; indeed, they vary so much as to render a separate consideration of

them necessary. Nevertheless, it has been the custom to regard the fatal contingencies of all ages in the mass, without making this distinction. The differing liability to death at the two terms of life has, on the other hand, been amply demonstrated.

I shall consider, then, first, the causes of death after Lithotomy among adult patients. And these causes will be examined, as far as possible, in the order of their importance, that is to say, according to the frequency of their occurrence. Afterwards the causes in children shall be investigated separately.

I. The first, and, beyond all doubt, the most frequent cause, is acute inflammation of the tissues, especially of the loose cellular tissue around the neck, base, and sides of the bladder; always of a destructive character, and generally with a tendency to invade other parts.

This inflammatory action may be caused by mechanical violence, by urinary infiltration through too deep incisions, by want of reparative power in the patient, from erysipelas, &c.

1. By mechanical violence inflicted in the removal of the stone, especially when the opening is of insufficient size.

The great majority of authors affirm that infiltration of urine is the most common cause of death, a statement that I venture not only to call in question, but to regard as the source of serious error in practice. Infiltration of urine is one of the causes of suppuration, and destructive inflammation of the perivesical cellular tissue, but it is by no means the universal one. The doctrine based on this belief is as follows:—If the internal incision passes beyond the limit of the prostate in any direction, so as to open up

the cellular interspaces behind the deep fascia, urine is almost certain to find its way into them, and if it does so, fatal inflammation will result. In order, therefore, to avoid this danger, the internal incisions must be extremely limited. But, sound as the principle is to keep the internal incision strictly within the prostate in adult patients, in practice I am satisfied that the desire to limit it has been carried to an extreme degree, and that another and not less serious danger of arousing inflammation of the same cellular tissue has by this very means been increased ; I mean the danger which attends an attempt to drag the calculus through an opening of insufficient size. From what I have seen of the practice of Lithotomy in various hands both in town, in the country, and abroad, I am persuaded that insufficient internal incisions are equally dangerous with those which are too free, and that the tendency of the present day is towards the former extreme. The purely anatomical view of the subject appears just now to be in the ascendant. The vital attributes and dispositions of the organs involved are not sufficiently regarded. The student is taught to fear beyond all things an approach of his knife to the peripheral limit of the prostate, and, in over-dread of cutting it, he barely divides the prostate at all. Hence, the no less dangerous injury which results from violence inflicted by the forceps and by the stone upon the neck of the bladder, and from the powerful traction upon it, which injures, often irreparably, the loose cellular connections in which the viscus is embedded ; connections which are delicate in structure, and loosely applied, for the purpose of permitting free extension of its parietes to the varying condition of size, which its function as a reservoir of urine demands. Inflammation of

these delicate structures is easily produced by that process of forcibly dilating the neck of the bladder which insufficient incisions render necessary, through the pressure, sometimes producing sloughing, to which they are thus subjected; it is also no less certainly caused by traction downwards of the viscus, which inflicts injury upon them in the manner just indicated. And, when inflammation has once extended through these structures, it rapidly invades the peritoneum, which, very probably, is more frequently implicated in this manner than by any other agency. In connection with this subject there is a very significant fact, the bearing of which will be presently examined, viz. that while it is certain that the boundaries of the prostate are almost invariably overstepped by the knife in children, infiltration of urine very rarely occurs in their cases. Happily, also, infiltration does not necessarily follow such incisions in the adult, but they render it more likely to occur. That the prostate has often been completely divided with impunity for the removal of large stones is certain, and the risk incurred from that cause is unquestionably serious. Danger is always great in a ratio proportioned to the size of the calculus, but this arises quite as much from the violence inflicted in removing it as from the depth of the incisions employed.

Let it not be imagined from these remarks that any one can deprecate more strongly than myself the making of an incision in the prostate more deeply than the size of the stone demands, but I am very certain that it is safer to extend the incision when the stone cannot be extracted without exerting violence, than to inflict the injury which such a proceeding necessarily involves. The advocacy of small internal incisions by Scarpa, who laid down as an

axiom that an incision of five lines into the prostate with dilatation sufficed for the extraction of a stone of more than ordinary size;* and by Sir Benj. Brodie, in his admirable lectures here, as the sole or chief means of preventing urinary infiltration, has greatly influenced professional opinion on this subject. And I believe the effect may have gone even beyond the intention of its authors, since the force with which this particular source of danger has been insisted on by almost all subsequent writers, has led many to regard it as the only, or at least the main, evil, to be feared in the operation, and thus, perhaps, has indirectly occasioned the oversight of danger in the opposite direction. I wish here to point out, that in shunning Scylla, we may encounter Charybdis; that a great obstacle to successful Lithotomy lies on either side of our path, and not on one side only; that we must preserve the neck of the bladder equally from too deep an incision on the one hand, and from the mechanical injury necessitated by one which is too limited on the other. I fortify my position by reference to the significant fact that the most successful operators have been those who advocated sufficient incision as less dangerous than violent extraction. Thus Mr. Martineau, who is well known to have cut eighty-four cases at Norwich, with only two deaths, writes, in that brief and simple account of his method which he presented to the Medical and Chirurgical Society in 1821: "Should the stone be large, or there be any difficulty in the extraction, rather than use much force, while the forceps have a firm hold of the stone, I give the handles to an assistant, . . . while the part forming the stricture is cut, which is easily done, as the broad part of the blade becomes a director to

* Memoria sul Conduttore d'Hawkins, &c. Pavia, 1825.

the knife ; and rather than lacerate, I have often repeated this enlargement of the inner wound two or three times."* Cheselden himself had recorded a similar opinion. Describing his method of extracting the stone, he says :— "I first feel for the stone with the end of them" (the forceps), "which having felt, I open the forceps, and slide one blade underneath it, and the other at the top ; and if I apprehend the stone is not in the right place in the forceps, I shift it before I offer to extract, and then extract it very deliberately, that it may not slip suddenly out of the forceps, and that the parts of the wound may have time to stretch . . . , and if I find the stone very large, I again cut upon it, as it is held in the forceps."†

But, on the other hand, it is never to be forgotten—and Cheselden refers to it in the foregoing passage—that the *neck of the bladder is susceptible of dilatation to a very considerable extent, if only it be gradually exerted.* It yields first, to the pressure of the finger as it passes through immediately after the knife ; secondly, it dilates further in the act of sliding in the forceps upon the finger ; and lastly, it gives way still more when the forceps is withdrawn, containing a stone between its blades, especially if it be a large one. This, its susceptibility of becoming dilated, is of the utmost value to the lithotomist. Indeed, if it did not exist, and largely too, none but small stones could be withdrawn through any incision limited to the prostate only. But in order to take advantage of it, the dilatation must be made slowly and gently. If done

* *Méd. Chir. Trans.*, vol. ii. p. 411. It seems necessary to state from the manner in which Mr. Martineau's practice is sometimes quoted, that this series of eighty-four cases did not by any means constitute his entire experience, the remainder of which was by no means so successful.

† Cheselden's *Anatomy*, 5th Edition, 1740, p. 231.

hastily, harshly, and forcibly, under the influence possibly of the contemptible vanity of achieving a rapid operation in the eyes of bystanders, it is not dilatation which has been accomplished, but rupture. And by rupture I do not mean the mere enlargement of the wound in the prostate and neck of the bladder, which, probably, is often and legitimately occasioned, but the rupture of the surrounding cellular connections with the numerous veins and the capillary network which traverse them ; results of an extremely dangerous character. In this way, inflammation of the cellular tissue, pelvic abscess, or it may be phlebitis, are set up ; suppuration is produced in a situation where the pus finds its way to the peritoneum, and not to the surface. And when this state of things exists, a deep incision would have proved a safeguard rather than the contrary, by affording exit to the confined matter. It is wholly impossible, then, to overrate the importance of slowly and gently dilating the neck of the bladder and the incisions which have been already sufficiently made, and of giving abundance of time both in the act of introducing the forceps, and in that of withdrawing the stone. If there be any single proceeding in connection with the practice of Lithotomy, no matter what is the operation performed, which demands more than any other of care, attention, and self-command, I should say it is the manner in which we traverse with instruments the wound in the neck of the bladder. Nevertheless, one may have sometimes observed that the operator rapidly passes and repasses instrument after instrument, especially if any difficulty arise, and pulls and twists, with breathless haste and excitement, the calculus through the narrow outlet. Nothing can be more dangerous, nothing more likely to occasion the evils which

have just been described. I am strongly inclined to think that in many hands the forceps, and not the knife, is the most deadly instrument employed in Lithotomy. On this important subject permit me to adduce here two brief quotations from the writings of two experienced and accomplished lithotomists, one of the past and one of the present age. Pouteau, during the last century in France, says :—"The extraction of the stone is, perhaps, the most delicate part of the operation, since it has often caused fatal results when it has been done without sufficient prudence and management. If we permit ourselves to be seduced by the dangerous merit of doing the operation in the shortest possible space of time, the eagerness with which extraction is made, occasions a rupture, often mortal ; and I am persuaded that the thoughtless anxiety to acquire this false glory, that the public attaches to rapidity in operating, has killed more patients than any other evil manœuvre. It is impossible to proceed too slowly in extracting the stone and I believe it is to a scrupulous adherence to this precept, that I owe in great part the constant success of my operations." *

Dr. Keith, of Aberdeen, after describing the method in which the forceps is to be applied, adds :—"There are few operations to which the adage *Festina lente* does not apply. To Lithotomy it is especially suitable, and to this stage of it peculiarly applicable. At it, 'Make haste slowly' should be ringing constantly in the surgeon's ear."

I cannot forbear to add the remarkable fact that, in the numerous opportunities of discussing the details of the operation of Lithotomy, which I have enjoyed, either personally or by letter, with many of the most experienced

* Œuvres Posth., tome iii. p. 350.

lithotomists of the day, and I refer especially to the provincial surgeons of our own country, that this is the single particular on which all are agreed. One, possibly, may attribute his success almost entirely to the use of the beaked, instead of the pointed, knife; another, to the smallness of the internal incisions; a third, to the freedom of the same incisions; a fourth, to the invariable use of the tube after the operation; while a fifth employs it only in rare and exceptional cases; but one and all agree in the vital importance of extracting the stone with great care and gentleness, and of giving *time in abundance* to this part of the proceeding. I may add, that Dr. Murray Humphry, of Cambridge, who has had a large and remarkably successful experience, attributes his success in great part to care in removing the stone. He writes me—after describing in detail his method of proceeding—“the desideratum in the operation is to extract the stone with as little damage as possible to the parts.”

2. Death after Lithotomy may result from rapidly-spreading inflammation produced by urinary infiltration into the cellular interspaces between the pelvic viscera when they have been opened up by too deep incisions.

This result, although undoubtedly occurring sometimes, does so much less frequently I believe than is usually supposed. It is true that at a post-mortem examination, after a large stone has been with difficulty extracted, the cellular connections of the neck and base of the bladder are found to be broken up; sloughs of the connective tissue appear bathed in fluid seropurulent and urinous, and marks of peritonitis, especially severe in the pelvis, are observed. But there is good reason to believe that, in most cases, urinary extravasation is not the primary cause of the

inflammation, but that inflammation has been the occasion of the urinary extravasation. Cellulitis, produced by violence, has first destroyed the connections in the manner described above, and then the urine has rapidly infiltrated the disintegrated tissue, and has lighted up a virulent peritonitis, or intensified a previously-existing one. Such appears to be the true explanation of the phenomena which mark the progress of events during the period, more or less brief, which follows the operation in many fatal cases.

Infiltration by no means necessarily occurs when urine passes over the newly-made section of cellular *spaces* so called. In fact, cellular *interspaces* between muscles and between viscera do not exist except when made by the anatomist for the necessary purpose of demonstrating the planes of cellular tissue which unite adjacent organs, and facilitate freedom of movement between them. I very much doubt if urinary infiltration ever occurs when they are otherwise uninjured, in a person of fair vigorous health. To judge from the language held respecting this subject, one would imagine that hollow intervals existed between the organs in question, over which urine had only to be poured in order to be drained mechanically into them. No such thing exists. In the child, where the cellular connections are of the loosest and most delicate kind, and where the bladder is active, powerful, and irritable, urine flows constantly after this operation over a cut surface which affords free access to them: nevertheless, with what extreme rarity do we meet with urinary infiltration in the child! But once inflame this cellular tissue, destroy its healthy character, or even, perhaps, let the patient be of unsound health, or one in whom "the flesh never heals well," to use

a common phrase, and then we have the condition in which urinary infiltration may take place with rapid and fatal effect.

I am aware that this doctrine is opposed to the generally-received notions on this subject. I speak with great respect for existing views, but careful pathological study of the subject by the bedside of the dying patient, and at the subsequent autopsy, has convinced me that the true cause of death in the majority of cases, the cause that it most behoves the operator to guard against, is violence in opening up the internal part of the wound, and laceration of the tissues there, and not the primary passage of urine into the cellular connections about the neck of the bladder. Happy is it if it be so, since the first it is in his power to avoid ; the second is a danger which would be often inherent in the operation and unavoidable with a stone much above the average size. That it is not an inherent necessity in the operation, seemed to me to be indicated in an early study of this difficult and important subject, by the fact that forty or fifty consecutive cases of Lithotomy might be cut, and have been cut, without a single casualty. If it were a fact that cellular interspaces could not be cut without the gravest risk to life, how could such a result be possibly accounted for ? It was necessary to suspect the existence of a graver cause, and here the comparison of living phenomena with anatomical appearances led me to conclude that the cause is avoidable and not inherent. To sum up the subject ; it appears that in the majority of cases death is due to unnecessary violence inflicted on the neck of the bladder and parts adjacent, occasioning destructive inflammation of the connective tissue, and of the network of minute bloodvessels which pervades it ; and that when

this has taken place, and not until then, does infiltration of urine occur, when it rapidly and frightfully augments the already-existing danger. In some cases a small quantity of poisonous fluid, associated with, or resulting from, decomposed urine, probably enters the circulation by absorption, and produces those depressing constitutional symptoms which always accompany this accident; and which are dangerous in proportion to the diminished capacity of the kidneys to eliminate the poisonous matter from the blood, and of the constitution itself to overcome the shock which it invariably sustains in these circumstances. Lastly, in all, or nearly all, instances, the irritating fluid soon reaches the peritoneum, and if the powers of life are not already exhausted, fatal peritonitis is the necessary consequence.

3. Fatal inflammation of the cellular connections of the bladder sometimes takes place when neither of the above-named causes are present.

Cellulitis may occur after any lesion in unhealthy or predisposed subjects; or where erysipelas is prevalent; and in this manner it sometimes undoubtedly attacks the connections of the bladder as a sequel to the incision in Lithotomy, although they may be strictly confined within the limits which anatomy prescribes. This is the form which is more likely to prove fatal if patients in hospitals are imprudently placed in crowded wards, or where erysipelas is rife, instead of, as has for many years been our practice in University College Hospital, to place them in a private ward, or in a ward with only six or eight beds, in which erysipelas rarely occurs, or is at once removed, if it does so. Herein, probably, is one of the causes why our results have been so successful there.

II. Inflammation of the mucous membrane of the bladder itself, rapidly leading to inflammation of allied vital organs, is another cause of death after Lithotomy.

We have considered the effects of inflammation of tissues around and outside the bladder, so to speak, and its dire effects, as the most frequent cause of death after Lithotomy. The cause which appears to be next in order of frequency is inflammation within the bladder, namely, of the internal or mucous lining. And this condition also, like the preceding, while it must be regarded as a grave complication itself, may also become the medium by which inflammation extends to other organs, inducing a complication which is graver still. Thus, from cystitis may arise, and with extreme rapidity, inflammation of the kidney on the one hand ; on the other, inflammation of the peritoneum. The first is generally announced by rigors ; then follow vomiting, intense pain, suppression of urine, coma, and death in twenty-four, thirty-six, or forty-eight hours. The second is often more gradual and insidious in its progress ; tenderness in the hypogastrium and a little fulness first exciting attention, the usual signs of low peritonitis following in their order. Among such cases perhaps are found the very few examples of recovery which do take place after peritonitis, for when it has been produced by infiltration of urine I believe recovery never takes place. With counter-irritation and hot applications externally, and opium internally, with nutritious support and stimulant, here and there a patient survives. Among the first class of cases, viz. those in which the renal implication, as exhibited by rigor and suppression of urine, has taken place, the principal chance lies in an early single cupping over the kidneys, followed by hot and stimulating applications to the

loins. But if the renal organs have been the subjects of disease before, and it is more than probable that they have been so in the instances where this complication occurs, the prognosis is of the gravest character. The course of these latter cases somewhat resembles that which is exhibited by those belonging to the class next in order for consideration.

III. Death may occur after Lithotomy from absorption into the system of poisonous products derived from the urine.

In these circumstances, the fatal event sometimes takes place with great rapidity, a day or two after the operation ; the symptoms suddenly appearing, and consisting mainly of very great prostration and diminished secretion of urine. There is every reason to suspect that the constitution is labouring under the effects of a violent and fatal poison suddenly absorbed. The active symptoms ushering in inflammation of the kidney, alluded to in the preceding section, are not present, but the patient rapidly exhibits the intensely prostrating effects of poison in the blood, which the emunctories of the body, but especially the kidneys, are unable to eliminate. It would appear in this case that it is not so much the mere inability of the kidney to perform its office of throwing off the natural excretion from the blood, and so permitting the poison to accumulate there, but that some products of decomposing urine and of unhealthy discharges, possibly from the neighbourhood of the wound, have been taken up into the system, and are poisoning it with intensely rapid and fatal action. And the elimination becomes still more difficult, or, indeed, impossible, if the kidneys have previously been the subjects of organic morbid change. Judging, at least, from analo-

gous conditions in other circumstances, this seems to be the best explanation of the fatal phenomena presented. They are sometimes, but erroneously, I think, regarded as signs of shock and exhaustion. Such conditions occur doubtless, but in a manner which is distinct from this kind of fatal event. They will be considered in due course.

IV. PHLEBITIS AND PYÆMIA.—As all surgical operations are liable to give rise to these unhappy results, Lithotomy is not exempt. Pyæmia, however, undoubtedly ranks low in the list, happening unfrequently in comparison with other fatal issues. It has its origin probably in inflammation of some of the veins which are abundant about the neck of the bladder, and which are liable to injury by violence rather than by section with the knife.

V. Death by shock is not unfrequently spoken of. I imagine that by this term it is desired to express that the event of operation produces so great an exhaustion of the nervous energy, that the action of the heart is rendered too feeble to sustain a circulation adequate to support life. The patient is the subject of collapse, just as we see in those cases in which the brain has suffered mechanical violence in concussion; just also as sometimes happens in extensive mutilations of the body, death occurs not from mechanical injury to vital parts, but from the profound impression upon the nervous centres, which extensive destruction of tissue produces. The operation of Lithotomy, particularly if protracted and severe, appears in some individuals to produce this effect of shock. It must be regarded as a rare termination; and it has probably become more rare since the employment of anæsthetic agents, because two great elements of nervous depression, dread of suffering, and endurance of suffering itself are

almost certainly eliminated. Shock when it occurs can therefore now be mainly due to physical injury, and not to emotional perturbation. Shock, then, is to be distinguished from those rapidly-occurring terminations which have been already attributed to poisoning by urinary products, and to renal disease ; as well from that which is due to exhaustion, next to be named in the order of arrangement.

VI. HÆMORRHAGE AND EXHAUSTION.—These two are placed together, for reasons which will appear. Death by primary hæmorrhage may be said almost never to occur in Lithotomy, that is, death directly due to loss of blood. For, first, hæmorrhage of a severe character rarely takes place. Secondly, if it does appear, it is usually very readily controlled ; either by the ligature, the tenaculum, the curved needle, plugging, cold, or by manual pressure. Secondary hæmorrhage sometimes takes place, and patients have been reduced to the lowest condition by it ; indeed, an instance or two of death may have been rightly regarded as directly due to it. But all this, let it be distinctly observed, suggests no inference to the practical surgeon that hæmorrhage is therefore not to be regarded as a dangerous, or even as an indirectly fatal, occurrence. On the contrary, free bleeding, continuous bleeding, and bleeding that tends to recur, are always to be regarded as circumstances of very evil augury for the well-doing of the patient. Such hæmorrhage lowers the powers of life, impairs the adhesive action in the wound, and therefore also the resisting power in the newly-cut surfaces to the action of urine and other products passing over them. It diminishes the patient's power of resisting infection, or other deleterious influences which may be around him, and enervates him for the struggle with them, when it has commenced.

Lastly, it may endanger, and in any case prolongs, the period of convalescence. In this view of the subject, then, hæmorrhage is inevitably allied to exhaustion, and exhaustion ought rarely to exist apart from this cause. There are some old and worn-out cases in which the slender chance of operation is accepted by the patient only in his last extremity ; when being already exhausted, and with powers past recruiting, he must be brought to the operating table. These are exceptional, however ; in most cases a patient should not, and need not, be submitted to this ordeal in an exhausted state. But if hæmorrhage be unavoidably severe, or be not checked by every means at hand, we shall risk a fatal encounter with exhaustion, and indirectly not a few deaths are thus met with. It is not easy, in these circumstances, to replenish the exhausted system. It results, then, that the surgeon should, during the operation, regard his patient's blood as valuable in the highest degree, and whatever may be his views respecting its loss under other circumstances, he should rest assured that every ounce of blood lost in Lithotomy is, *pro tanto*, a positive injury to his patient.

VII. TETANUS.—Two or three cases are on record of death by tetanus following the operation of Lithotomy. Beyond the bare mention of this fact, no further remark appears to be necessary respecting this extremely rare event as a consequence of the operation.

THE CAUSES OF DEATH IN CHILDREN.—The causes of death in children are widely different from those which are met with in adults. This distinction, as far as I can ascertain, has not, as yet, been sufficiently pointed out. The causes of death after Lithotomy have been treated as if they were uniform at all ages ; although it is very

obvious from observation of their cases, that the fatal result in the adult and in the child almost always happens through a different chain of events. This has rendered less distinct in each respectively the danger to be most feared, and, consequently, the cause most to be avoided. On investigating this subject in the adult, we have seen that haste and violence in extracting the stone, and sometimes unnecessarily-extended incisions, are the causes of that diffuse inflammation of the cellular connections around the base of the bladder, which proves so generally fatal. We shall find in the child that the danger is not, or is very rarely, due to diffuse inflammation, and that incisions beyond the prostate can scarcely be reckoned dangerous, since they are constantly practised, yet no class of patients exhibits half so many recoveries per cent. We shall find that the most frequent cause of death in children is peritonitis, which is by no means common in the adult, and after that, and nearly as frequent, is constitutional exhaustion.

It will make our path clearer if we first consider the causes which render Lateral Lithotomy so much less fatal in the child than in the adult, a fact notorious to the youngest student of surgery. I believe them to be threefold. First; Lithotomy is not a very fatal operation in the child because the sexual organs are not yet endowed with that special sensibility, the development of which constitutes the state of puberty; a sensibility which, depending on most intimate connection between those organs and the cerebro-spinal system, necessarily associates them by the closest ties with all the other vital functions in the economy. So that any shock or injury received by the adult sexual apparatus very frequently involves constitutional sym-

pathies of a very grave character. In the child there is, in fact, no sexual apparatus ; that is to say, its condition is at present rudimentary, and the young patient is exempt from the danger which exists in the circumstances pointed out. This is the first and the chief fact in favour of the child. The second consists in this ; that the processes of growth, and, consequently, of repair, are more vigorous during childhood than during any other term of life ; and injuries are more rapidly and more easily surmounted than when those processes are less active. There are special adverse influences at certain periods of childhood, which counteract, to some extent, the beneficial effect of this, as we shall presently see. Thirdly, the position of the bladder in children favours very greatly the continuous and complete discharge of urine, and of all noxious secretions after operation, a fact which is doubtless of some value in their cases.

Now, the liability to death after the operation of Lithotomy in childhood varies very much at different epochs of that period. A table at the end of this work containing 850 cases of children, shows that, from the first to the fifth year inclusive, the deaths are about one in fourteen cases : they then decrease, so that between six and ten years inclusive, they are only one in twenty-three or twenty-four cases. Between eleven and sixteen the mortality gradually rises to one in nine-and-a-half cases, and from the sixteenth to the twentieth year to one in seven cases.

During the first three or four years of life Lithotomy is far less successful than during the subsequent period. The first dentition with its dangers is now encountered, and the excitable nervous system of infancy neutralizes some of the advantage which arises from the reparative power

of childhood already referred to. But as these two constant sources of disease and death during the earliest years cease to be effective, we find the boy of six to ten years but very slightly exposed to risk from Lithotomy, the mortality being one in twenty-three or twenty-four cases, or little over four per cent. The development of puberty shows its influence in a marked manner between twelve and sixteen, and during the first onset of its influence on the system between sixteen and twenty, before the man is fully developed, and before the body has become established and fortified, Lithotomy is slightly more hazardous than at any period during the subsequent twenty years.

It has been already stated that the most frequent cause of death in children is peritonitis. The bladder in children is an abdominal organ rather than a pelvic one, and has more intimate relations with the peritoneum than the bladder of the adult possesses. On examining its structure also, it is easily seen that the peritoneum is more entitled to its anatomical distinction of constituting one of the vesical coats in the child than in the adult. Hence, violence in extraction tells much more readily and directly on the peritoneum in the former than in the latter. In the adult we have seen that if the peritoneum is inflamed, it is rather by an extension through primary inflammation of the cellular tissue around the neck of the bladder, than by direct irritation occasioned by the operation. The converse condition is the rule with children. The undue manipulation of instruments in the cavity of the bladder, or exertion in withdrawing the stone, appear to excite peritoneal inflammation much more readily than any other lesion. That it does not happen in children by the intermediate step of urinary infiltration, is obvious from the

fact that the prostate in them is so exceedingly small, as to be almost always, if not invariably, cut wholly through in Lateral Lithotomy, yet without the occurrence of that accident. Indeed, it is not possible that either forceps or finger can pass into the bladder, unless the incision exceeds the thickness of that organ. In considering this matter there appears to be a tendency to forget a fact I have already alluded to, viz. the non-existence at this period, except in a rudimentary form, of any sexual organs. I have dissected many prostates in children; the size of one at seven years, let us add therefore at the most favourable age for Lithotomy, may be estimated from the fact that it weighs about thirty grains, while between eighteen and twenty years it weighs two hundred and fifty grains, or nearly nine times as much. And yet no infiltration of urine takes place; lax, delicate, and yielding as are the cellular connections necessarily exposed in these subjects.

Here then, again, as in the adult, the fatal injury from the operation is more commonly due to violence than to any other cause, but telling directly on the peritoneum, rather than on the cellular connections of the bladder. Such is the inference I deduce from the study of numerous cases of death in children, respecting which I have been in a position to form opinions. Some corroboration of the views here put forth may be found also in the fact respecting deaths which have been known occasionally to follow the mere act of sounding in children: viz. that it is always due to peritonitis. Fletcher, of Gloucester, in his most instructive record of "Failures in Lithotomy,"* relates the case of a child, six years old, and in excellent health, who died of acute peritonitis in three or four days, after a

* Med. Chir. Notes and Illustrations, Part I. Lond. 1831, p. 89.

prolonged sounding for suspected stone. Mr. Crosse also mentions a case precisely similar.*

The next cause of death is exhaustion. Young children bear the loss of blood badly, and when it is considerable, an occurrence which, however, is rare, the patient sometimes sinks from subsequent exhaustion. The condition of calculous children also, if the stone has long existed, is occasionally low in the extreme, and they gradually sink without any apparent effort to rally, no active attack having declared itself.

Besides these two principal causes of death, there are occasional examples of fatal result from shock after very prolonged or severe operation; from disease of the kidneys and bladder, from phlebitis and intrapelvic abscess, which demand no special remark here.

* Treatise on Calculus. Lond. 1835, p. 43.

CHAPTER VI.

DIFFICULTIES AND DANGERS MET WITH IN LITHOTOMY.

1. Difficulties and Dangers peculiar to the Age of the Patient—those of Infancy.—In Age, Rigidity of Tissues; Enlargement of Prostate, &c.
2. Difficulties from Personal Peculiarity in the Subject—Deep Perineum; Narrow Pelvis; Unusual Distribution of Arteries; &c.
3. Difficulties due to Peculiarity in the Stone—Size; Form; Number; Situation; Contraction of Bladder on Stone. Accidents—Wound of Rectum; Removal of Portion of Prostate; Fragments remaining after Operation; Secondary Hæmorrhage; Wound remaining Fistulous; Impotence; Incontinence of Urine; no Stone found at Operation.

THERE are several exceptional circumstances, any one of which may, when present, become an occasion of more than ordinary difficulty to the surgeon in the performance of Perineal Lithotomy. Furthermore, it is certain that the degree of difficulty for the surgeon must be generally regarded as the measure of danger to the patient. There is therefore no duty more necessary, and certainly there is no inquiry more interesting, than that which relates to the sources of such difficulty and danger; because most, if not all of them, may be discovered and identified, not, indeed, by a reference to the practice of any single lithotomist, but by an extended research into the experiences of many. And the value of this inquiry will appear from a fact, the validity of which will be admitted by all, namely, that to be forewarned of the presence of difficulty, and

prepared to meet it, diminishes, by one-half, its magnitude in most cases.

For the sake of convenience I shall arrange these difficulties in three classes. First, difficulties which are peculiar to the age of the patient.

Secondly, difficulties which arise from peculiarity in the subject—and,

Thirdly, difficulties which arise from some peculiarity in the stone, or in its relation to the bladder itself.

First, difficulties which are peculiar to the age of the patient.

The period of infancy is one which presents peculiar difficulties to the operator, difficulties not present at any other period of life. The structure of the organs interested is extremely soft and yielding; and the connective tissue which unites them is lax and feeble to a remarkable degree. From this condition arise two sources of difficulty and danger, which the operator has not unfrequently to encounter. First, the staff is liable, if undue force be used, to be pushed through the walls of the urethra, commonly at some point in its floor below the pubic arch, and thus to find its way below the bladder, between it and the rectum, where the mobility of the instrument, permitted by the laxness of the cellular connections there, may lead the operator to believe that its point is in the bladder itself. The same thing may happen in the adult, but from the cause stated, co-existing with the sharp curve upwards of the urethra in this situation in the child, it more readily happens in the latter. If this error is made, and is not discovered in time, the operation fails to extract the stone, and almost invariably inflicts a fatal blow on the patient. And its not unfrequent occurrence proves that it

is by no means a remotely possible danger. There is one great rule which, as far as I know, is the only absolute safeguard against the performance of an operation on a staff which has not been passed into the bladder; and it is, *to require clear audible or tactile proof of contact between the stone and the staff, on which the patient is to be cut.* We may find the stone with a sound, while the patient is on the table, but the staff may be passed immediately afterwards with perfect ease and not find it, the difference of form in the two instruments being considered sufficient by the operator to account for the two different results. It is wise not to be so easily satisfied. I have known cases in which, before the patient came under the operator's hands, a false passage has been made, the existence of which was wholly unsuspected by him, until the operation had been commenced, the knife had bared the staff, and the frightful discovery then made, that the instrument was outside the bladder altogether. His sound had passed into the vesical cavity, but the staff, having a larger curve, had found its way into the false route, no fresh laceration having been made by him. In one instance, a patient, with marked symptoms of stone, had been, in consequence, repeatedly sounded in a distant part of the country, but no stone had been found; this result being doubtless, in part, the cause, and in part the effect of the false passage subsequently found to exist. Two precisely such cases have come under my immediate observation. If the difficulty has actually presented itself at the operation, the surgeon must not hesitate an instant to withdraw his staff, to slide another staff of any curve that will pass safely into the bladder and detect the stone there, and then to finish the operation upon it. But if, owing to the false

passage, he can pass no instrument after a fair amount of endeavour, all proceedings should be suspended without any further use of the knife until another day.

The other difficulty which arises in these cases from the soft and lax nature of the tissues, is the facility with which the membranous urethra may be separated from the prostate. This sometimes happens, when, after the deep incision, an attempt to introduce the index finger into the urethra fails, and issues instead in pushing onwards the prostate and neck of the bladder until separation takes place. The accident may occur in two ways. The operator may, through fear of having his deep incision too free, make a section of the urethra and prostate insufficient to admit the tip of his finger, and in attempting to dilate the opening with it instead of incising afresh, the catastrophe occurs. Or, in the act of opening the membranous urethra, he loses his hold upon it with the nail of the left index finger, and repeats the incision once or even twice before he fairly gets his knife into the groove of the staff, and runs it on towards the bladder. The urethra meantime may have shifted its position slightly, and three or four adjacent separate notches have been made into it. If only a small amount of force be employed in the subsequent attempt to pass the finger into the urethra, its separation from the prostate may also take place. This source of danger has been pointed out by Mr. Ferguson in some valuable clinical remarks on the operation in children.

The remedy, when this accident has occurred, is first to ascertain that the point of the staff is still in the bladder, and then to make a free incision of the prostate with a sharp knife, so that the finger may be introduced into the

cavity : this will generally be successful. A pre-acquaintance with the danger, however, will be the best safeguard against its occurrence.

A difficulty which sometimes presents itself in the cases of children (very rarely in adults) is prolapsus of the rectum during the operation. Young calculous patients are frequently subject to this affection from the straining which their complaint occasions, and when a considerable protrusion occurs at the moment of operating, some embarrassment may be occasioned. All that is necessary, however, is to press up the bowel without haste, so as to ensure its fair return, to put a pad on the anus, and direct an assistant, placed on the patient's right side, to keep his finger firmly on the pad until the operation is completed.

The other extreme of life is also liable to its peculiar difficulties. There are two which are met with, and only in elderly subjects ; namely, unusual rigidity of the neck of the bladder, and hypertrophied prostate.

The first has been less generally regarded than perhaps it deserves to be. In many elderly subjects, the fibrous structures which form the neck of the bladder, and enter into the composition of the prostate and surrounding parts, have become unnaturally rigid and unyielding. In early life the converse condition exists, hence the impunity, indeed the success, with which considerable dilatation can then be made. This condition of rigidity varies much in degree in different subjects, and is quite distinct from hypertrophied prostate, but as a rule it corresponds more or less to the advance of age : there are, however, some exceptions. In a marked case the tissues yield little to the finger, or to the forceps ; the opening sufficient for the removal of a stone of given size in ordinary cases here feels tense, and

inadequate for its purpose. The forceps being introduced, it is perceived that dilatation is not taking place, and unless deeper incision is employed the stone cannot be extracted without violence. In either case risk is incurred by violent laceration, or by extended incision; the smaller risk, however, probably lies, in careful hands, with the latter, although it is undoubtedly true that more force is admissible in this condition than in the normal state of the tissues. It is referred to by Mr. Crichton in his MS. notes as usually associated with enlarged prostate, and while he enlarged his incisions he did not hesitate to use more force in extracting than he was ordinarily accustomed to employ. Civiale has remarked its existence, and regards it as diminishing the prospects of success; where this condition is marked, and the stone is large, a second incision may be made through the right side of the prostate, supposing that in the left to be already sufficiently free. This was Liston's practice at University College Hospital; he performed it in 9 cases there for very large stones with 7 recoveries; among them was one stone weighing $3\frac{3}{4}$ ounces and another of $4\frac{1}{2}$ ounces.

The prostate enlarged by hypertrophy, or deformed by tumour, is another difficulty presented by age. I am not disposed, however, to rank it high in the scale either of difficulty or of danger. It prevents the forefinger reaching the bladder; it increases the distance between the operator and the stone, and so augments the difficulty of seizing and extracting it; and it does the same by placing the stone in a disadvantageous position, that is, lying in a deep basfond, or there may be projecting tumours at the entrance of the bladder, situated between the stone and the inner end of the wound. Hence such tumours have not unfrequently

been torn away by the forceps in the process of removal. On the other hand, deep internal incisions in an enlarged prostate are comparatively free from danger, and there is no fear of reaching its external limit. The gorget is a safe and efficient instrument in these cases for extending the deep incision ; it forms an excellent conductor for the forceps into the bladder when the finger cannot reach it, and keeps projecting tumours out of the blades, which might otherwise be lacerated, or brought away in their grasp. When the stone lies deeply behind an enlarged prostate, it may be reached with a curved forceps ; it may also generally be brought into good position for extraction, by placing one or two fingers in the rectum, and raising the stone towards the level of the internal wound.

In elderly subjects, also, it occasionally happens that the bladder has become atonied, and has not been able to empty itself by its own efforts for a long period of time. In the gush of water outwards after the deep incision, the bladder collapses rather than contracts, and the stone may be enveloped in folds of the organ, a circumstance sometimes productive of much trouble. Careful manipulation of the forceps, or better still of the scoop, with pressure by an assistant on the hypogastric region, will generally enable the surgeon to reach and remove it. In these cases, however, it appears to be wiser to operate with a nearly empty bladder than a full one ; the stone will then be found at the neck, close to the internal incision.

2. Difficulties which arise from some personal peculiarity in the subject.

Among the first in this category may be noticed the deep perineum. Sometimes this is constituted by a variety of formation in which the bladder is more deeply placed

as regards the surface than in ordinary cases : and resulting most commonly from unusual depth in the ischia and pubic rami. It is also presented when the patient is exceedingly stout, the layer of adipose tissue over the perineum and especially on the nates, sometimes adding very materially to the distance between the surface and the bladder. In this case it is necessary to make the external incision longer in proportion at both extremities, remembering that the incision in such a subject commences on a plane three-quarters of an inch to an inch further from the bladder than in an ordinary case. Otherwise, the wound will be too narrow in proportion to its depth, and will be dangerously so should the stone be a large one. The remarks respecting the use of the blunt gorget in cases of hypertrophied prostate apply here also.

Another difficulty is presented by the unduly narrow pelvis. The pelvic outlet may be congenitally contracted, or it may be deformed by rickets. Cases are on record in which it was impossible to bring any stone through the outlet, but such are extremely rare. Still it is not so uncommon to find the passage sufficiently narrowed to occasion some difficulty in extracting a stone of moderate or large size. The distance between the two ischial tuberosities is always a matter of observation to the lithotomist before operating, and his incisions are placed so as to allow him a fair equal distance between the rectum in the middle line and the osseous boundary on the outer side. But this is not all ; it is particularly desirable in such cases to present, in the act of withdrawing the stone, which has usually a short, as well as a long diameter, the short one to the narrow diameter of the pelvis.

Other difficulties peculiar to the subject are, the unusual

distribution of the vessels, rendering serious hæmorrhage unavoidable ; the existence of the hæmorrhagic diathesis ; the presence of organic disease in the kidneys or elsewhere ; of extremely nervous or irritable temperament ; of plethora, obesity and debility combined, a not uncommon, but most unpromising, condition ; and lastly, of great exhaustion from long-continued suffering. The unusual distribution of arteries referred to is a difficulty which cannot be foreseen or avoided. The pudic trunk being defective, its place is sometimes supplied by an "accessory pudic," which lies close to the border of the prostate ; the arteries of the bulb may be given off further back than usual ; the main artery of the prostate itself may also enter the gland in a situation exposing it to the knife in Lithotomy. In all these cases, the skill, the energy, and the patience of the surgeon, may be taxed to their utmost, to arrest the hæmorrhage occasioned by the division of these deeply-lying vessels : see remarks on hæmorrhage at page 44. The other conditions named above will be briefly referred to in the final appreciation of various methods of treating varied classes of patients.

3. The third class of difficulties encountered in Lithotomy comprises those which are due to peculiarities in the stone, or in its relations with the bladder itself. Other things being equal, it has usually been held, and it was proved by Mr. Crosse, of Norwich, in his comprehensive view of the contents of the Norwich Museum, that, after moderate dimensions are exceeded, the danger and difficulty of the case exist in proportion to the size of the calculus to be removed. In other words, danger and difficulty exist in proportion to the extent of the incisions, or to the degree of violence employed in extraction. Thus, reckoning all

the examples in that museum, he showed that the proportion of deaths to cures when the stone was between one and two ounces in weight, equalled about one to five and a half cases; when between two and three ounces, it was about four to five cases: and of the twenty calculi above that size, viz. from three to seven ounces, twelve died and only eight recovered. This rate of mortality must be considered rather high. On the other hand, if we turn to the practice of Mr. Crichton, a remarkable success in this class of patients is exhibited. In the records which I possess of his practice, I find no less than eleven cases, in which he removed, by the lateral operation, stones weighing upwards of four ounces, most of the patients being very feeble and broken down in health. Among them were only two deaths.

No. 1,	aged 73,	weighing	4 ounces,	cured.
2,	„ 60,	„	$4\frac{1}{4}$ „	do.
3,	elderly,	„	$4\frac{1}{2}$ „	do.
4,	„ 70,	„	5 „	do.
5,	„ 66,	„	5 „	do.
6,	„ 65,	„	$5\frac{1}{2}$ „	do.
7,	„ 40,	„	6 „	do.
8,	„ 45,	„	6 „	do.
9,	„ 72,	„	$6\frac{1}{2}$ „	do.
10,	about 65,	„	7 „	death
11,	„ 55,	„	8 or 9 „	{ Broke in extraction, largest fragment weighed 6 ounces, 2 or 3 ounces of debris be- sides; died on third day.

The greater part of these were cut during the earlier half of Mr. Crichton's career, when he opened the bladder with the cutting gorget, and in some he divided the right side of the prostate as well. His method was, as we have

already seen, marked by freedom of incision in these circumstances and care in extraction. In order to get as firm a hold as possible, after having adjusted the position of the calculus in the forceps, he was accustomed to slip up by the side and over the end of it, a bent hook or scoop in order to make traction and prevent slipping. Two only of the foregoing series were purposely broken into fragments before extracting, and in each case it was done by simply compressing the handles of the stout and strong forceps which the operator was accustomed to use, and not by means of any unusual or complicated instrument.

These results demonstrate what the lateral operation is capable of effecting in the removal of large calculi. Nevertheless, both in London and in Paris, it has been a common custom to employ for stones of about four ounces and upwards, some special apparatus for fracturing the calculus in order to extract the fragments through a smaller wound than would be necessary for the entire stone (fig. 46). The principle of action is dictated by prudence. To limit the incision as much as possible, without doubt conduces to the safety of the patient. Still, it is impossible not to be aware that great additional hazard is involved in the employment of such apparatus in the bladder; and in contemplating it for any particular case, this must not be overlooked. I have witnessed its application more than once, and have been impressed with difficulties arising from three causes:—

1. The manipulation requisite for fixing the stone securely in the grasp of the instrument when the bladder is emptied of fluid, as it invariably is, and for crushing it subsequently, must be always considerable, and liable to produce mischief.

FIG. 46.

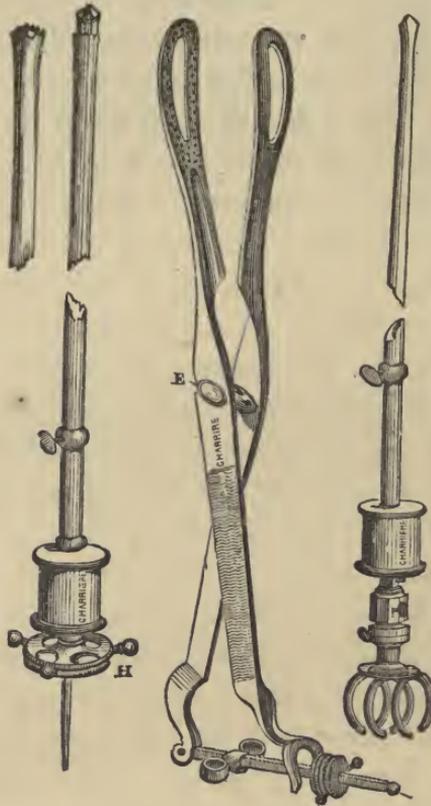


Fig. 46. French forceps, with a screw in the handles, for breaking large stones. An apparatus is used for drilling the stone, if the forceps cannot crush it. The figure on each side of the centre represents a perforator, which is introduced through a ring at E, passes between the blades, and is worked in the one case by a drill bow, and in the other by the wheel H.

2. The removal of numerous angular fragments from the empty bladder is a fruitful source of severe injury to it.

3. The danger of leaving some small fragment in the cavity renders much manipulation and much washing-out necessary, or the risk of a second formation may be regarded as imminent.

These grave considerations should be weighed by the

FIG. 47.

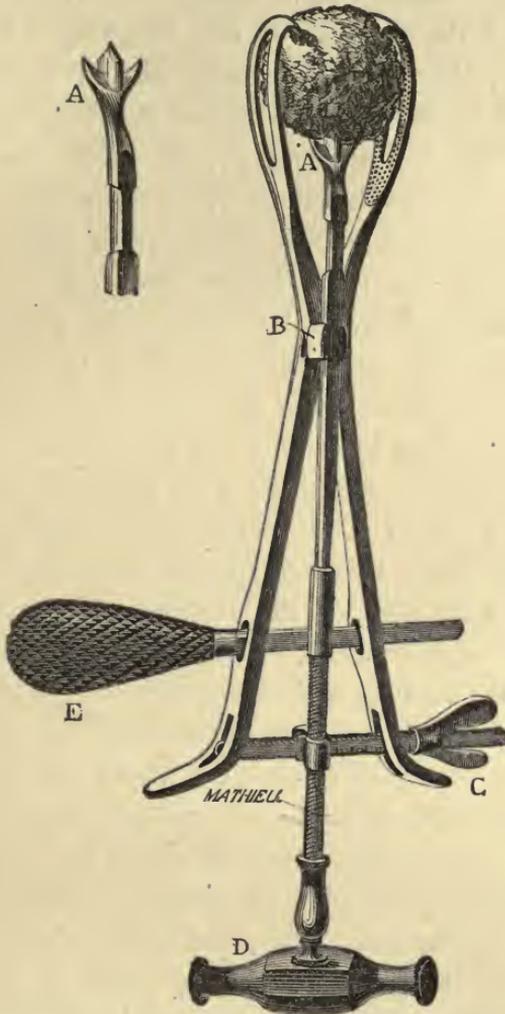


FIG. 47. Another instrument for the same purpose, acting by pressure and by drilling.
A, the toothed extremity of the drill.

operator before deciding on any course. In performing Lateral Lithotomy for a large stone, a well-constructed and powerful crushing instrument should undoubtedly be at hand. Stones have been successfully removed by such means which never could have been brought through the

pelvic outlet entire. Mr. Mayo, of Winchester, thus accomplished the removal of one weighing $14\frac{1}{4}$ ounces, avoirdupois; the patient recovering with a small fistula.* Instruments for this purpose existed at a very early period in the history of Lithotomy; even before the time of Celsus, who refers to the practice.† Ambrose Paré describes his improved forceps, with screw-power in the handles, in order to crush the stone before removing it.‡ Le Cat modified them, and invented an instrument for perforating the stone also; his instruments, especially those with which he made the incisions, were extremely complicated.§ Of late years numerous attempts have been made to improve these instruments, commencing with those of Mr. Earle.|| The question which arises, however, in such exceptional cases, is the choice between Lateral Lithotomy with this adjunct, and the high, or the rectovesical operations. In relation to the first named, another question of importance arises, viz. the capacity and extensibility of the bladder. If the viscus is capable of being distended with urine, so as to be fairly appreciable somewhat above the level of the pubic symphysis, a stone of unusual dimensions may probably be more safely removed entire in this situation than by adopting the plan of crushing it after the lateral operation is performed. The great source of difficulty and danger in the latter mode is *the empty state of the bladder*, and I believe it is scarcely realized by those who have merely made or designed instruments for the purpose, and who appear to have overlooked the important distinction

* Med. Chir. Trans., vol. xi. 1821, p. 54.

† Celsus, De Medicinâ, lib. vii. cap. 26.

‡ Paré's Works, lib. xvii. cap. 42.

§ Parallèle de la Taille laterale. 1766. See Plates and Descriptions at the end.

|| Med. Chir. Trans., vol. xi. 1821. With a Plate.

between this condition and that which obtains in ordinary Lithotriety, where fluid is always present. But if the bladder is habitually contracted round the stone, and does not admit of distension by fluid; if it cannot, therefore, be found reaching the level of the symphysis, those who are most acquainted with the high operation tell us that it is by no means a safe operation to undertake in such circumstances. And it appears to be more common to meet with a contracted bladder than with a dilated one when a stone of unusual magnitude is present. Such was the condition of things in a case which was under my own care in 1857, and from which I possess two calculi weighing $12\frac{1}{2}$ ounces.* These formed, for all the purposes of operation, but one calculus, being so closely locked together that it is scarcely possible that either could have been removed separately. The patient was in so miserable a condition when he came under my notice that I could not advise any operative measures, and attempted only to palliate it, and perhaps enable him to regain some vigour. This, however, proved impossible; his urinary organs being all but destroyed by long-existing chronic inflammation. At the autopsy I endeavoured to remove the mass by the high operation, and found it totally impossible, without opening the abdominal cavity. The bladder had long ceased to be a receptacle for urine, which trickled off as fast as it arrived from the kidneys; the stones being closely enveloped by its thickened and diseased coats. I doubt if any operative means would have been successful in his case; but judging from the examination referred to, it appeared to me that the best chance would have been offered by

* Trans. Path. Soc., vol. ix. p. 295.

practising extended incisions on the plan of the rectovesical operation. This latter procedure must be regarded, for the majority of cases, as permitting the largest opening with the smallest amount of risk for stones which are unusually large. In the method of performing it, described at page 66, no danger exists from hæmorrhage; the amount of tissue cut is by no means considerable; and the opening is admirably situated, in the very centre of the pelvic outlet. On the other hand a strong probability exists of the subsequent occurrence of intractable rectovesical fistula. Experience of this operation has shown that this distressing condition follows, taking all cases together, about once in four or five instances. But when it is resorted to for stones of extreme magnitude, the chances are somewhat greater still that the wound will remain fistulous.

There is a practical point of importance to be noticed in connection with very large stones. It is the very slight evidence which can be obtained of their presence by sounding in certain cases. I first became aware of this on examining the patient just alluded to. I was convinced from his symptoms that he was the subject of calculus; but still, although repeatedly sounded by me and by one or two others, distinct evidence of the fact was at first wanting, for a clear note could not be obtained. A sensation indicating the presence of mortar-like matter was felt, on the instrument passing through the neck of the bladder, and after that, nothing.

I find in Mr. Crichton's notes the record of a similar fact. In one of his earliest cases, occurring in March, 1792, the signs, he says, were very indistinct; and, on

his proposing to operate, one of the surgeons who had come to assist him left the room, stating that he could not be a party to any operation in such circumstances. Mr. Crichton, however, felt satisfied that a stone was present : operated at once, and removed a hard one weighing six ounces, the patient making a good recovery. He records also a second case almost parallel with the foregoing.

Other characters of the stone causing difficulty to the operator are, unusual form and extreme brittleness. A long stone, and a thin, flat stone, are both difficult to remove and require careful adjustment in the forceps, or the aid of the scoop, before attempting to extract. Large round tuberculated stones are also formidable, and for equal weights are obviously much more so than smooth oval stones. A stone, also, which easily crumbles into fragments is always a source of trouble and anxiety. It prolongs the operation, makes much instrumental manipulation necessary, and the fear of leaving a fragment behind is always present. The scoop and the syringe as a rule afford the best means generally of dealing with these cases. The syringe should have a nozzle like that represented at fig. 7, page 18 ; a form for which we are indebted to Dr. Gross of America. On this account it is that Lithotomy, after the failure of Lithotrity, is sometimes associated with risk and difficulty, and especially if the bladder has proved irritable previously. Similarly, multiple calculi are sources of some difficulty, although less so than are numerous fragments. Instances of two, three, or four calculi are common. I have seen upwards of twenty in a single bladder. Examples of between one and two or three hundred are on record. Next to great size, the unusual situation of a calculus may be a source of much

difficulty and embarrassment. A certain proportion of calculi become encysted in the bladder. Not so many, perhaps, as the statements made by operators who have found difficulty in extracting calculi, and who have consequently believed them to be encysted, would lead us to infer. But we have the best anatomical evidence that it is not extremely rare for this to happen. A calculus may be altogether contained in a cyst in the bladder, a small part of its surface only being exposed at the mouth of the cyst. I had the opportunity of watching at University College Hospital an example of this, which was once, and once only, struck with a sound during life, although sounding was repeatedly performed. The patient remained during a large part of 1850 under the care of Mr. Arnott ; at death the condition described was found, and it was then obvious that the chance of striking such a calculus was exceedingly remote, and that no operation could have removed it.*

But it is not uncommon, when this condition occurs, that fresh calculous matter is added, little by little, to the exposed surface, so that, in process of time, a calculus is formed, protruding into the bladder, in which situation it increases in size ; a narrow neck exists uniting the vesical to the encysted portion, and the whole acquires a form somewhat resembling that of an hour-glass.

One of the most interesting examples on record is that of a man, aged fifty-one, with stone, who applied to Dr. Murray Humphry, of Cambridge, who operated by Lateral Lithotomy, removing a large one. Two years and a quarter afterwards, symptoms having recently appeared, Dr. Hum-

* Very fine examples of encysted calculus are contained in the Museum of the Royal College of Surgeons. See preparations Nos. 2019, 2020, 2021.

phry performed Lithotrity three times, but this being unsuccessful he cut him again in the same spot. Two years and a half after he came again with recent symptoms, and Lateral Lithotomy was again successfully performed. In the next year he again complained, and Lateral Lithotomy was adopted a fourth time, still in the site of the old cicatrix, but an encysted stone was discovered, and after many attempts could not be extracted owing to its distance from the wound. In six months he once more showed himself, and this time Dr. Humphry did the recto-vesical operation : was able to reach the cyst, incised the sac with a hernia knife, dilated it with the tip of his finger, and, with much difficulty, guided the forceps, extracting a stone the size of a walnut. Death occurred in two days with peritonitis. At the autopsy, the sac was found just above the entrance of the right ureter ; it was ulcerated at the lower part, and urine had found its way from it under the peritoneum. A second case fell to the lot of Dr. Humphry, in which, at the second lateral operation, he discovered a cyst behind the prostate ; he lengthened his incision, applied a probe-pointed knife to the neck of the sac, and emptied it of softish material with the scoop, and a portion or two by the dressing forceps a day or two after ; the patient did well and continued so.*

Last year I exhibited at the Pathological Society for Mr. Cadge, of Norwich, a good specimen of encysted calculus. It was removed by him during life with a portion of the cyst adhering, like a collar to the neck, uniting the two portions, and the patient recovered.† Two such cases

* Report of some cases of operation. By G. M. Humphry, M.D., F.R.C.S., Surgeon to Addenbrooke's Hospital, Cambridge. London, 1856.

† Trans. Path. Soc., vol. xii. p. 136. I exhibited a case of my own also (post mortem); see vol. xii. p. 138.

occurred in Mr. Crichton's practice, who minutely describes his proceedings in the MS. notes ; one case in 1842, one in 1844. In all three cases the stone was situated near the neck of the bladder, and in the two latter on the right side. Mr. Crichton says of each patient that he observed when sounding, which he repeated two or three times, the signs being rather indistinct, that the stone seemed always to be fixed at the right side of the bladder. He writes : "The bladder was cut into, and the presenting portion of the stone laid hold of by the forceps and quickly extracted, broken off at the neck : a grooved director was then introduced into the bladder, and insinuated between the edge of the sac and the encysted portion of the stone, which, by a little perseverance, was so much raised from its confinement as to allow the forceps to get a hold, and another portion broken off and extracted. This was several times repeated till the whole was brought away." The same proceeding was adopted in both cases ; and both recovered. Very recently Mr. Lawson presented a good example of encysted calculus at the Pathological Society, which he had removed with the forceps aided by the scoop ; in this case it was partially contained in a sac, and no supplementary portion projected from it.* The rarity of the occurrence is, however, demonstrated from the fact that operators of large experience rarely meet with more than one or two cases in a lifetime. Deschamps and Brodie each record but one case. Probably no better mode of dealing with encysted calculus can be pursued than those which have been described.

Sometimes a little embarrassment is occasioned to the surgeon by his discovery that the calculus is more super-

* Trans. Path. Soc., vol. xiii.

ficially placed in the perineum than he expected; on his encountering it, in fact, before arriving at the bladder. A vesical calculus may be found occupying partly the bladder and partly the prostatic urethra; or two or more independent calculi, locked together, may be thus placed. It is necessary, of course, to remove that which first presents, after which there is usually not much difficulty in entering the bladder, and extracting the rest. Mr. Fergusson exhibited an example of this kind at the Pathological Society. Examples exist also in the Museum of the Royal College of Surgeons, in preparations Nos. 2026, 2027, and 2039. A large stone may even escape from the cavity of the bladder into the sac of an abscess in its walls, which has recently burst: a very remarkable example of this rare condition is seen, No. 2029.

Spasmodic contraction of the bladder, rendering the removal of the stone difficult, is described by some high authorities. It is regarded as something distinct from the condition which is present when the bladder has been merely emptied of urine, and therefore somewhat closely surrounds the stone. South, Brodie, and Gross speak of it, the two former recording cases in which it has been met with. Great care in the efforts made to extract, avoiding violence either with the scoop or forceps, and even waiting a little, are necessary in such cases. True spasmodic contraction of this kind is probably extremely rare, and when present it is not unlikely that chloroform may overcome it. When the bladder has become preternaturally small, and its coats are habitually applied closely to a large stone, there is sometimes great difficulty in removing it. The forceps must be manipulated with great care, and an additional hold with a well-curved scoop passed between the

bladder and the stone, and beyond the latter, aids materially in dislodging it.

Sometimes the stone is lodged in the upper part of the bladder behind the pubic symphysis. Possibly this may be due sometimes to the spasmodic contraction just alluded to, but more generally, I believe, its position there is to be attributed to peculiarity in the form of the viscus, caused by hypertrophic thickening of the coats. The stone is habitually lodged there, and the vesical walls become thickened, partly by the process referred to, and in part from inflammatory deposit into their structure, impairing their power to dilate or contract.* Here pressure above the pubes, firmly maintained by an assistant, will enable the operator to dislodge the stone.

Calculus is sometimes said to have been found (at the operation, not on post-mortem authority) adhering by lymph to the inner coat of the bladder. There is little evidence in support of this statement. That which is derived from the sensations of the operator while in the act of removing the stone cannot be received as of much weight, since many conditions may occasion difficulty in its removal, erroneously suggesting to the mind the existence of some organic connection between the bladder and the foreign body. There is no doubt that if the condition does exist, it must be excessively rare. I only would not say that it is impossible. Granting theoretically its existence, it is not half so common as some operators, especially inexperienced ones, have affirmed it to be.

* Excellent examples of this condition may be seen in the Museum of the Royal College of Surgeons. The preparation No. 2016, for example, is that of a bladder divided into an upper and lower cavity by a partial contraction in the middle ; the upper portion was filled by a calculus, which it would have been next to impossible to extract by Perineal Lithotomy.

The mucous membrane of the bladder is, although very rarely, found to be coated with a layer of adhering calculous matter, and this I believe to be the nearest approach to "adherent calculus" that anatomical researches have produced. In the Museum of the Royal College of Surgeons is the preparation of a bladder (No. 2024), the mucous membrane of which is studded with small calculi, partially embedded in minute sacculi, but between the calculi the mucous membrane is covered with a thin layer of calculous material; at least half the inner surface is thus coated. This condition would be a very embarrassing one in any operation. No. 2025 exhibits a similar appearance, only much less marked in degree. In No. 2023, the prostate has an enlarged median lobe, which is similarly coated: several small sacculated stones co-exist.

The following case recently occurred to Mr. Wormald at St. Bartholomew's Hospital. A lad, aged 19, was admitted with symptoms of stone. When sounded, calculous matter was felt with the end of the sound in every direction. The circumstances of the patient were regarded as unfavourable to operation, and he died in a few weeks. At the post-mortem examination a thick crust of concretion concealed the entire mucous membrane of the bladder, and could be peeled off in flakes. The kidneys were the seat of tubercular deposit.*

There are several accidental circumstances occasionally met with in Lithotomy, which, not exposing the patient's life to risk, cannot be comprised in a discussion on the difficulties and dangers of the operation; but which are, nevertheless, productive of great annoyance, and even of misery, to those who are, unfortunately, the subjects of

* This case was recorded in Med. Times, Nov. 19, 1859.

them. These will be enumerated here as accidents concurrent and consecutive.

Taking them in the order of their occurrence :—

1. The first accident which may be met with is that of wounding the rectum. It is very rare, and probably does not occur, if the knife be held with a moderate degree of obliquity, and proper care be taken to guard the position with the left hand, unless the bowel is unusually capacious, as in some elderly subjects ; or is distended with fœces, as may happen when the preliminary purge or enema has not acted before the patient is placed on the table. This accident may take place in the first, or in the second incision, or while withdrawing the knife, if the operator enlarges the opening in that act. In any case, however, when an incision into the bowel has been made, and it is only small, no notice need be taken of it ; if it is considerable, most authorities have advised that the opening should be freely enlarged through the margin of the bowel and sphincter. But the necessity for this proceeding is by no means proved. Probably, the best method is to leave the parts untouched, and to reserve division of the sphincter until the necessity of it appears from the non-cicatrization of the wound, as such cases have been known to recover soundly when not interfered with.*

2. The removal of a portion of the prostate gland by laceration, or otherwise, is not a very uncommon accident with elderly patients. It may occur in two very different

* Mr. South states that he has seen only two cases of wound in the rectum, both of which healed well without any incision.—Chelius' Surgery, vol. ii. p. 606, Lond., 1847. Samuel Cooper says he saw it "in three or four cases, but no serious consequences were the result."—Surg. Dict., 7th ed., p. 935. Mr. Key only once witnessed this accident, and no bad result occurred. Dr. Gross gives a decided opinion against interference.—Urinary Organs, 2nd ed., p. 590.

ways: first, it sometimes, but rarely happens, that the section of the prostate divides, or exposes freely, one of those small rounded tumours which so frequently exist embedded in the substance of the organ, especially in elderly patients; under which circumstances the tumour becomes very easily enucleated. Secondly, when an outgrowth, more or less projecting or pedunculated, exists at the neck of the bladder, springing from the prostate into the vesical cavity, it is apt to be caught between the blades of the forceps when seizing the stone, and to be torn off in the act of removing it. I have myself witnessed this accident three times, and in no one of the cases did it appear to endanger life.* Dr. Keith informs me that he has met with it nine or ten times, and he is not aware that material injury resulted in any instance. Mr. Key made a similar observation.† Nevertheless, it appears to have sometimes prolonged the recovery by retarding the healing of the wound. On the other hand, the patient has been known to pass urine more freely than before, but whether this has been due entirely to the removal of the stone, or whether in part also to the loss of an obstruction, it is not possible to decide. However, there can be no doubt that the accidental removal of these growths should be avoided, and with this object the left index-finger, when exploring the bladder, and subsequently when acting as guide to the forceps, or adjusting the position of the stone, should ascertain also, if possible, the presence of prostatic growth, and guard it from inclusion or laceration, when the operator

* I had the opportunity of exhibiting for my friend Mr. Cadge, of Norwich, at the Pathological Society of London, three tumours of this kind, weighing five scruples, removed from a patient the subject of two large stones, who recovered.—*Path. Trans.*, vol. xiii. p. 155.

† “Remarks on the Lateral Operation of Lithotomy.”—*Guy's Hospital Reports*, 1837, p. 23.

is dealing with a patient of advanced age. If, when such a growth exists, he determines to get rid of it, as is sometimes done, it is better to do so with probe-pointed scissors than by tearing it off or even than by excising it with the scalpel.

3. It is sometimes discovered within a few days after the operation, that one or more calculi, or fragments of calculus, remain unextracted. This is a serious accident and ought very rarely to happen, although, from unavoidable circumstances, it may occur to the most experienced operators. The course to be adopted must depend, in some measure, on the condition of the patient. When only small fragments are present, they will frequently pass spontaneously by the wound. If otherwise, and the patient is in course of recovery, and his prospects are good, the first step is to ascertain precisely the size of the fragment or calculus remaining. This may be done by a lithotrite, or measuring sound, passed through the urethra. If the calculus is found to be one of medium, or inclining to large size, it will probably be wise to place the patient again on the table, dilate the wound, and remove the foreign body with the forceps: if inclining to small size, it may be crushed through the urethra. On the other hand, if the patient is not in a promising condition, he must be left for the present, unless the presence of the calculus is manifestly occasioning so much distress as to render it probable that his improvement may be rather facilitated than diminished by interference for its removal.

4. Secondary hæmorrhage. Hæmorrhage occurring at, or immediately after, the operation, is an accident liable to occasion considerable hazard; it has, therefore, been considered in describing the steps of Lateral Lithotomy (see

pages 43-7). But it is sometimes secondary, taking place at a period of seven to ten, or even fifteen days after the event, and then it must be regarded as an accident which no foresight could have prevented. It occurred in a case of my own nine days after. (See Chap. XII., Case No. 10.)

The remedies must depend on the character and continuance of the flow. If controllable by the ligature, no means is so safe and certain; but at this stage such a result is not to be expected, since the external wound has generally by this time become small. The finger should be introduced, to ascertain whether by pressure with its point the source of bleeding can be stopped; if so, a piece of lint attached to a probe, or stick, and dipped in a solution of the perchloride of iron should be applied to the spot. Sometimes the actual cautery has been found effectual. At the same time local cold applications should be made to the perineum and adjacent region. Mr. South records several of these cases in which pressure with the finger on the pudic artery for several hours was necessary in order to save life.

5. Occasionally the wound which follows the operation heals very slowly, and results in the persistence of a fistulous track from the prostatic urethra to the perineum. This is an exceptional, yet not a very uncommon, occurrence. Most operators number in their experience a certain small proportion of such cases. The fistulous opening depends sometimes on the deposit of phosphatic matter on the raw surfaces of the wound from unhealthy urine; such was the condition of one of the cases already referred to, in which injury to the prostate had been occasioned. The deposit may become permanent at the upper extremity of the passage; in other words, may form a calculus there, which,

until removed, will assuredly maintain the patency of the fistula. If, then, we have ascertained that no such foreign matter exists in the track, the whole internal surface of the fistula should be lightly touched with the actual cautery in the form of a heated wire, or with the galvanic cautery, or with a probe coated with nitrate of silver. After this the patient, having previously learned to do it with facility, should withdraw all his water on every occasion for three or four weeks by catheter, provided he can accomplish it easily, so as to prevent any flow through the fistulous channel. By a perseverance in this plan success may be obtained in several, perhaps in most, cases. It has been recommended to allow a catheter to remain in the urethra and bladder for some days with the view of withdrawing all the urine in this manner. But this mode of treatment is not successful. Urine soon trickles by the side of the instrument and so enters the fistula; and the urethra itself becomes irritated, and much purulent discharge is secreted from its mucous membrane, conditions very unfavourable to the healing of any fistula. On these grounds, and from the observation of its effect in numerous cases of urethral fistula, I very much prefer the employment of the catheter by the patient on each occasion of his requiring to pass water. There are still a few cases met with, which it must be confessed appear to be wholly intractable, and these for the most part probably owe their character to the existence of disease in the prostate gland.

6. A result of the lateral operation, which very seldom occurs, is sexual impotence. This condition has been attributed to the division of the seminal duct which lies nearest to the line of incision. There is good reason, I think, to

doubt the correctness of this supposition. First, the line of incision ought never to intersect the duct even on the side operated on; the knife must be carried almost vertically downward in order to endanger it; indeed, if it be employed with even a less degree of obliquity than has been previously advised, the vessel will still be safe. Secondly, the duct of the other side must in any case remain intact, for it is difficult to conceive the possibility of an operator dividing both; and if one is left uninjured it will be superfluous to state that sexual impotence following the operation is not the result of the surgeon's knife. The real cause of this happily exceedingly rare sequence to the operation is rather to be sought in some morbid change affecting both the seminal ducts, and which may be produced by the lesion of Lithotomy as it now and then is by other lesions. When prostatitis has terminated in chronic prostatic abscess (I do not refer to periprostatic, so often mistaken for it), and this has involved in destruction all, or nearly all, the structure of the gland, the ducts sometimes become obliterated or sealed by plastic effusion, and loss of sexual function results. The vesiculæ seminales may then be found exhibiting the same condition, having become the seat of abscess, their structures being injured or atrophied. This condition I have seen, not only following abscess, but also as the result of tubercle in the prostate and vesiculæ. When, therefore, loss of virile power follows Lateral Lithotomy, I believe it is generally due either to sloughing from violence, or to inflammatory action in and around the ducts and vesiculæ seminales, destroying the function of these organs as conduits for spermatic fluid; and not to the mechanical division of one or both of them by the knife. The fact is an extremely difficult

one to verify : long-continued and patient watchfulness for the opportunity of dissecting cases can alone determine precisely the actual lesion which has destroyed the function in question.

7. Incontinence of urine occasionally follows the operation. It occurs more frequently in patients below the age of puberty than in adults. Apart from those rare instances of extremely large stone in which the neck of the bladder has been extensively damaged, no very clear explanation of the cause can be afforded, although speculative statements respecting it have been frequently made. Nor, perhaps, is it possible to offer any therapeutical considerations relative to it, differing from those which are available for incontinence occurring in ordinary cases, the numerous and varied modes of dealing with which need not be recapitulated here.

8. A very unfortunate accident remains to be noticed, which is occasionally, but by no means frequently, encountered : viz. inability to discover any stone in the bladder when the operation has been performed.

In the first place, the stone may not be found because it is so small as to be washed out with the first gush of urine from the bladder. I have seen Lithotomy performed for a stone no larger than an apple-pip, and no small embarrassment arising in consequence of the occurrence named. It has happened, not very unfrequently, that after a long and fruitless search in the bladder, a very small concretion has been found on the floor, or in the receptacle placed to receive the blood and urine, or embedded in a clot, or even adhering to some part of the operator's dress. But this ought not to happen, mainly because cases in which the calculus is so minute should

not be subjected, as a rule, to Lithotomy at all. We shall see hereafter in the final application, in Chapter XI., how necessary it is, before performing any operation, to ascertain the size of the stone, that we may select an operation which is adapted to it.

Again, an operation may prove fruitless because the stone is fixed in a cyst of the bladder, and cannot be detached from its place. This is very rare; because if the presence of a stone can clearly be verified by means of the sound, it is almost invariably sufficiently free in the bladder although it may be partially encysted, to be removed by some means. See the management of encysted calculi at page 118. More rarely still are the following conditions met with. A bladder is sacculated, and one of its sacs is large, and communicates by a considerable opening with the original cavity. The latter state is rare, such openings being almost always small. But the patient is also the subject of calculus. The stone is usually in the bladder proper, where it is readily struck by the sound, but occasionally escapes into the sac, where there is no possibility of reaching it. Here, as in the preceding case, if its presence cannot be made out satisfactorily with the sound at the time of operation no incision should be made.* Lastly, no stone may be found at the operation, because none has ever existed. The surgeon may have repeatedly sounded his patient, may have satisfied himself and others that he is the subject of calculus, and yet no stone whatever may have been present. Thus, the existence of a

* It may be as well to say that there is a material distinction between the terms "cyst" and "sac" as used here. By cyst I mean a cavity in the walls of the bladder, fitting to, and embracing closely, the stone which is always lodged in it: by sac, one of those large dilatations of one or more of the vesical coats, found independently of stone, but in which one may sometimes be lodged.

polypoid tumour in the bladder, probably with some calculous deposit adhering to its surface, has deceived the surgeon. Such a case was many years ago cut for stone ; the preparation is now in the Museum of St. Thomas's Hospital.*

Again, it has happened that a rugose and hardened condition of the muscular fibres of a hypertrophied bladder has misled the surgeon, when sounding, into the belief that he has struck a stone. Still, nothing like the clear and ringing sound of a calculus can be elicited from such a source. The bony walls of the pelvis particularly, according to some authorities, may furnish similarly erroneous impressions to the operator. But in both these circumstances, the tactile impression and the audible sound are dull and heavy, not so clear and defined as the metallic click of a stone. Yet the fact exists that highly-experienced and able surgeons have been misled by one or other of these causes.† Few have the courage and the honour to enlighten their brethren by publication of the case after an experience of this kind. Mr. Paget, of Leicester, has very recently offered a noble exception to this remark, in furnishing the particulars of an instance in which he operated without discovering stone. In his case, that of a child, the click, although heard by several, was not satisfactorily distinct on any of the occasions of sounding which had taken place, while the symptoms were exceedingly severe. The operator, however, desired to relieve the sufferer if it were possible, hoping that a partially-encysted stone might be the cause. Death occurred after two days, and at the

* South's Chelius, vol. ii. p. 551.

† Cheselden, Roux, Dupuytren, and Crosse have operated and failed to find the stone.

post-mortem examination no calculous matter was found in the bladder, but the ureters were enormously dilated. On repeating the act of sounding, the click was reproduced, and it was discovered to be due to the point of the sound impinging upon the iliac portion of the brim of the pelvis, the edge of which was unusually thin and sharp."* This case, in some measure, confirms the opinion of Mr. Gutteridge, of Birmingham, who had, with a like admirable candour, previously published the fact that he had "operated in three cases, wherein the most confident assurance the sense of touch was capable of giving was had respecting the existence of a stone," and had, nevertheless, found none. The patients lived, but by subsequent inquiry and experiment on the dead body, Mr. Gutteridge came to the conclusion that the deception is due to the sound striking some part of "the bony fabric of the pelvis itself;" and he defines the precise spot to be the spine of the ischium, a part rarely touched, except when the suspected stone not being at first found, a prolonged and extended search is made; and he adds, "the sound or staff being brought to the ischiatic ring, on either the right or the left side, and kept pressed there, will procure a sensation like that caused by touching a large rough stone."†

After experience and statements like these it may appear somewhat hardy to say that I am unwilling to relinquish my belief in the possibility of distinguishing between the click of a stone, and a sound produced in the manner described. I have repeated the experiment on the dead body several times, and I am quite unable to elicit a note, or to perceive a resistance by striking the sound against

* British Med. Journal, Dec. 14, 1861.

† A Memoir on the subject, published by Mr. Gutteridge, Sept. 1860.

any portion of the bony walls of the pelvis, which is at all comparable with the results obtained by striking any kind of vesical calculus I have ever encountered in the bladder. The question is one of great interest, and is well worthy of further examination. Undoubtedly a certain very small number of patients who are not the subjects of calculus, have been submitted to the incisions of Lithotomy, under the impression that they were so. But I believe that this happens less frequently now than in former times. As the art of diagnosis becomes more cultivated, and the means of exercising it are improved, the number of these cases will be diminished. With our present means and knowledge, I venture to believe the mistake ought not to occur.

PART II.—LITHOTRITY.

CHAPTER VII.

LITHOTRITY.—INTRODUCTORY.

General Observations Relative to its Rise and Progress.—The Importance of Treatment Preliminary to the Operation.—Its Nature, General and Local.

I PROPOSE in this, the second portion of my work, to illustrate concisely the principles and practice of modern Lithotrity.

By this term, since custom has popularized it, all those processes may be denoted by which the stone is broken up, crushed, and powdered in the bladder, and by which the débris are removed through the natural canal of the urethra without the use of the knife.

Lithotrity is the product of rapid growth. Forty years ago it was but a theory. Thirty years ago it had barely made good its claim to be admitted into the list of recognized surgical operations. Each succeeding ten years has witnessed great improvement in its applications, and its increased capabilities for good.

The Lithotrity of to-day is not the Lithotrity of even ten years ago, but a safer and a better operation. An

operation which now is founded on principles, and regulated by well-defined laws deduced from a large experience ; no longer consisting, as in its infancy, in the mere experimental application of a crushing instrument to any calculus, which, being considered neither too hard nor too big, might be located in a fairly healthy bladder.

It is, therefore, the Lithotrity of to-day, its principles, and the practice logically deduced from them, which it will be my aim to expound and to illustrate here.

There is reason to believe that calculous matter has been occasionally removed by Lithotrity at various early dates, but no attempt seems to have been made to apply the principle, generally or systematically, until A.D. 1813, when Gruithuisen, a surgeon in Bavaria, proposed a plan for seizing and reducing to powder, by drilling, a stone in the bladder. Subsequently, in 1819, Elderton, a Scotch surgeon, published a somewhat similar proposal. Meantime, in 1817, Civiale, of Paris, designed his earliest instruments ; and was closely followed by Leroy d'Etiolles and Amussat, in the production of other instruments for the same purpose. It appears, however, that the first successful operations were undertaken in 1824, the honour of which belongs to Civiale, who performed them before a committee of the French Academy. Improvements in the method and in the instruments were subsequently made by Weiss, Heurteloup, Costello, Charrière, and others, as well as by Civiale himself, whose experience in the application of Lithotrity must be regarded as exceeding that of any living operator. It is his method, in the main, which will be expounded and illustrated here ; my experience, derived from the advantage of observing it in his own hands some years ago, and from practising it very frequently since, as

well as considerable opportunities of instituting comparisons with the practice of others, leading me to regard it as superior to any other with which I am acquainted.

TREATMENT PRELIMINARY TO THE OPERATION OF LITHOTRITY.—There is one very important topic in connection with Lithotritry which I do not propose to consider at length here ; the practical management of the operation itself being the main object in view. But it is impossible to pass it by altogether. I refer to the preparatory treatment which should precede, in almost every instance, the application of operative measures.

It is not easy to over-estimate the importance of preparing a patient who is to be submitted to an operation for the stone, for the final proceedings, whether cutting or crushing, which are to be adopted. By some operators of very large experience, the preliminary treatment is regarded not merely as an ordinary precaution, but as exercising considerable influence on the ultimate issue of the operation. This applies to both operations ; but, perhaps, more cogently to Lithotritry than to Lithotomy.

Among the calculous patients admitted into hospitals in the Metropolis, most show signs of general deterioration of the health ; the result of pain, loss of rest, and other depressing influences of their malady. Much may often be done to improve their condition before deciding on, or proceeding to, the operation. Others, however, and especially some patients from country districts, present much more promising signs, even although they may have been for a considerable period the subjects of stone. Nevertheless, it is unwise to admit even these cases to operation after a rest of only three or four days, and the conventional aperient. It is an error, I believe, to operate on country

patients, whether in private or in public practice, immediately after their arrival in London. However healthy the condition of such a case, it often happens, if operative proceedings are at once undertaken, that the patient soon afterwards becomes the subject of fever and exhaustion, and perhaps falls a victim in a few days.

A period of acclimatization must be passed through by most of them, during which the system is not in a condition calculated to support favourably a capital operation. Soon after the arrival of a country patient in London, he frequently feels a little feverish, digestion is deranged, and sleep disturbed. Generally, a dose or two of mild aperient, and more than ordinary care in diet, restore him quickly to his usual condition. Many persons, enjoying excellent health, always suffer in this way in a change from country to town residence. The change involves altered diet, altered habits, and the presence of numerous sources of excitement, disregarded by the native, perhaps unknown to him, but strongly impressing, and often disagreeably, the sensorium of the stranger. When to these are added the numerous sources of anxiety and discomfort which the subject of severe disease must additionally experience, and this at a moment when he is anticipating the crisis which he knows is to free him from it, but not without some risk to life, it is no matter of surprise that some nervous derangement should manifest itself in a variety of troublesome symptoms. It is this condition which I have often observed in the circumstances described, and lasting for a varying period, from three or four days to a fortnight, which should be surmounted, before any operative procedure is performed.

Apart from these considerations, but little reflection may

suffice to convince us, that in all cases it is unwise to cut into, and still more so to crush in, the cavity of a bladder, which is the subject of unchecked chronic inflammation, as almost all bladders containing calculus are, in a greater or less degree. In such a condition, a very little interference will often set up acute cystitis, and from this source morbid action may invade the kidneys and prove rapidly fatal. Some remarks by my esteemed colleague, Mr. Erichsen, on the causes of death after Lithotomy, are exceedingly appropriate in this place. He says:—

“That the mere cutting into the bladder is not a very dangerous proceeding, provided that viscus and the kidneys are healthy, is evident from the fact that in those cases in which surgeons have had to extract bullets, bits of catheter, &c., from this organ, bad consequences have rarely occurred though the operations have often been tedious; but in Lithotomy the case is different, for here the bladder is not only usually in a state of chronic irritation, but the kidneys are frequently diseased; and these conditions influence more materially the result of these operations than any other circumstances.”*

The inference is obvious. By endeavouring, through every means in our power, to allay the irritation of the bladder, and to tranquillize the nervous system disturbed by local pains and broken rest, we do more to insure a successful result for the future operation than by any other course whatever. If we can accomplish these objects, although at the sacrifice of a little time, prior to operation, we have a right to expect, other things being ordinarily favourable, the ultimate recovery of the patient.

We shall enjoin, then, for a few days, rest in the recum-

* Science and Art of Surgery. London. Third Edition, 1861, p. 1009.

bent posture ; and, according to the necessities of the patient, attention to the secretions, regulated diet, local bathing, possibly, in some few cases, washing out the bladder ; as well as anodynes and sedatives by mouth or rectum.

Demulcent drinks, decoctions of roots and leaves exercising specific effects on the bladder, are also useful. Among them, I know none, in these particular circumstances, so valuable as a decoction of the underground stem of *Triticum repens* ; a pint to be taken in divided doses daily.

One very necessary part of the preliminary treatment is the systematic employment of bougies, so as to accustom the urethra to the contact of a full-sized metallic instrument. Especially if the patient has not been the subject of catheterism previously, first a soft elastic bougie of middle size, and then metallic ones, should be passed through the urethra every other day or so, increasing the size on each occasion. Lastly, an ordinary sound, which much resembles the lithotrite in form, may be employed, and with it the stone may be found, and some conceptions obtained of its size and consistence. A little warm water should be injected into the bladder if much pus or mucus is present, and the urine is alkaline ; or water containing a small proportion of nitric acid, or of acetate of lead, especially if phosphates are found in the deposit. If no irritation follows, but if on the contrary the urine becomes freer from sediment, and the patient retains his water longer than before, we have already achieved an important step in the progress of the case.

If, however, these manipulations are followed by any marked signs of local irritation, or, *à fortiori*, by constitutional fever as well, we may infer that in the existing con-

dition of the patient, Lithotrity cannot be employed with advantage; indeed, not without some hazard. More preparation probably, or another operation possibly, will be necessary. The practice of Lithotrity without such preliminary steps, it is admitted, may be frequently successful, but in all cases they conduce materially to a favourable issue, not merely by exercising a beneficial influence on the organs, *but by seasonably indicating those cases in which further interference will be injurious.* When abscess, or purulent infection, or fatal fever, supervenes on the first sitting, as occasionally happens, it will be generally found that due preparation has been neglected. Had the result of instrumental applications, cautiously made in the manner described, been first ascertained in such a case, it is more than probable that grave consequences would have been avoided. It is this fact which gives such great importance to preliminary treatment.

We desire to have the following conditions present if possible. They are not necessary to the successful performance of Lithotrity, for results of a most valuable kind are happily often obtained in their absence. But they conduce greatly to success, and we therefore do our best to achieve them, or, in default, the nearest approach attainable.

1. A fairly capacious and not very tender urethra.
2. A bladder capable of containing 5 or 6 ounces of urine, not very irritable, yet possessing a moderate degree of tonicity, that is, capable of expelling its contents.
3. Fair general health.

CHAPTER VIII.

THE OBJECTS OF LITHOTRITY, AND THE PRINCIPLES ON WHICH INSTRUMENTS SHOULD BE CONSTRUCTED IN ORDER TO ATTAIN THEM.

All evil Results arise from mechanical Lesion.—Lithotrites constructed so as to avoid this.—Lithotrites in two Classes: with Fenestrated Blades and Plain Blades.—Functions of the former and of the latter.—Mechanical Powers adopted: the Wheel and the Screw.—Lithotrites of different Makers.

WHAT is the precise object of Lithotritry? is a question which must be proposed and definitely answered at the outset of any consideration of this subject. The object of Lithotritry is not merely to reduce a stone to fragments, although this is a necessary part of the operation; the ultimate end to be attained is *the reduction of the stone to powder*: such as, for the most part, can be voided by the patient without unusual or instrumental assistance: the making of fragments, therefore, is only one step in the proceeding.

It may be assumed as obvious that the principal evils arising in Lithotritry consist of, or are traceable to, direct mechanical lesion; in other words, inflammation of the bladder and urethra are in any case almost invariably caused either by instrumental interference, or the presence of sharp or angular fragments.

Therefore, although we cannot absolutely insure the

realization of our endeavours, we should aim first at reducing the stone to a condition in which it will least injure the mucous membrane, and be most readily expelled from the bladder, viz. that of powder; and secondly, we should endeavour to effect this object by the smallest possible amount of instrumental interference.

These two principles are to be constantly kept in view; they will guide us materially in the selection of instruments, and in numerous details connected with the operative treatment.

The subject of instruments will first engage our attention. The mode of applying them will follow: and here it may be well to remark that the practice of systematic, methodical Lithotrity—and such alone can be relied on for success—consists not only in the conformity of its proceedings to two or three general principles, but in attention to numerous details, the value of which experience has established. Each of these may be minute in itself, indeed, apparently insignificant at first sight to some minds; but each becomes important when the result of their aggregated influence is regarded. I feel, then, that no apology is due for the attempt to present a circumstantial exposition of these details, especially as I know of no published source where it can be found. Of one thing I am certain, they will not be deemed unimportant, or without value, by those who have a practical acquaintance with the difficulties and the risks which attend Lithotrity when pursued in ignorance of rules and without a method.

INSTRUMENTS FOR CRUSHING STONE IN THE CAVITY OF THE BLADDER: LITHOTRITES.—The subject of instruments is a most important one, and deserves a careful consideration from every student who wishes to practise Lithotrity

with success. There is much more to be gained by a knowledge of the minutiae of the mechanical arrangements adopted in the construction of the lithotrite than is generally supposed.

It should be remarked at the outset, that every point relating to the form, weight, size, and construction of a modern lithotrite, has been arrived at through long years of experience and careful attention to the necessities of hundreds of cases, and after the occurrence of numerous contingencies, not anticipated at first, but now provided for. No study of Lithotrity, whether it be pursued on the body or without it, is of much value, apart from a preliminary knowledge of the mechanical principles on which lithotrites are, or should be, constructed.

In order to save misunderstanding and circumlocution, it may be premised here that all lithotrites will be regarded as possessing the following principal parts. The blades (when acting together often called "jaws"), the shaft, the sliding-rod, and the handle (fig. 48). The blades are two in number; one distal (from the handle), immovable, continuous with the shaft, called "the female blade;" the other, proximal, movable, continuous with the sliding-rod, and called "the male blade." The shaft is perfectly straight, and forms the longest portion of the instrument, corresponding to the average

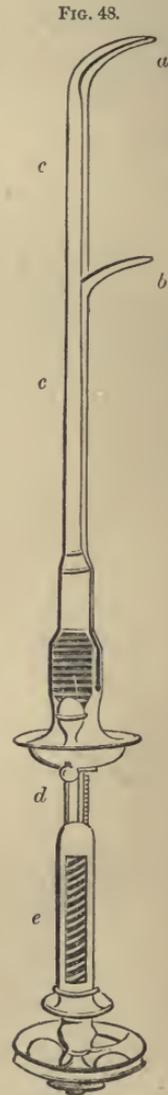


Fig. 48. Lithotrite; to show parts. *a*, female blade; *b*, male blade; *c*, *e*, shaft; *d*, sliding-rod; *e*, handle.

length of the urethra and three or four inches over. The sliding rod is received into a longitudinal channel, occupying the entire length of the shaft; it bears at one end the male blade, and at the other it is acted upon by the mechanical power employed. Upon its upper surface near to this end is marked a scale which informs the operator to what extent the blades are separated, when these are hidden, as in the bladder, from his eye. The handle not only serves the purpose which its name implies, but contains, or has affixed to it, the mechanical power which is destined to move the male blade.

Lithotrites may be regarded as naturally occupying two distinct classes; and the distinction is of much practical importance. It is grounded upon the nature of the work required to be done by them, corresponding to which must be the form of the blades or jaws which are to be brought into direct contact with the stone. The modes of applying power—and these are several—will be considered subsequently.

Class I. Lithotrites with the female blade open or fenestrated; or instruments for crushing the stone into fragments.

Class II. Lithotrites with no opening in the female blade; or instruments for reducing the stone or the fragments into powder; already said to be the ultimate object of all Lithotrity.*

* It has been customary with many in this country to apply the term "lithotrite" to the fenestrated instrument only, and to call those instruments which have entire or plain blades "scoops." This is an error, since instruments of both classes are employed for *crushing* the stone: it is, therefore, desirable to speak of them both as lithotrites. The custom is due to the fact that the fenestrated instrument only was used formerly in London for crushing, and the other for removing débris—a practice not much pursued in modern Lithotrity.

Before considering these separately, it will be well first to advert briefly to certain principles of constructing the blades which apply equally to both these classes.

1. The blades and the shaft form an angle with each other, which is always somewhat greater than a right angle. But the greater the angle, the greater is the sacrifice of power, and *vice versâ*: power acts disadvantageously through blades whose inclination from the shaft is more than 120° . On the other hand, the greater the angle the more easily the instrument passes through the urethra, a question of importance in some exceptional cases where much irritability exists.

2. The wider the blades the easier is it to catch a stone or fragment, and the less likely is either when caught to slip from the grasp of the instrument. But power acts disadvantageously through wide blades: a narrow male blade forces its way through a mass which could not be penetrated by a wide one; on the other hand, the grasp of a small fragment is much less certain to hold fast when one and especially when both blades are narrow, than with two wide ones.

3. The surface of the male blade which is opposed to the female blade is roughened, in order to render the grasp more sure, and because pressure between roughened surfaces tends to separate cohering particles; between smooth surfaces it favours their forming into a mass. If the object is to break a hard stone, the male blade should have a toothed surface, that each of the several projections may exert a wedge-like action on the resisting mass. But if the male blade consists of a single and, therefore, rather large wedge, although it will act most powerfully and efficiently on a large and hard stone, it is, nevertheless, an

objectionable instrument, because, as may easily be proved by experiment, the divided fragments fly off at right angles with great force, and endanger the walls of the bladder, as I have long ago verified. Hence, the male blade must not be too narrow in any case.

Class I. The lithotrite with an open or fenestrated female blade (figs. 49 and 50).

FIG. 49.

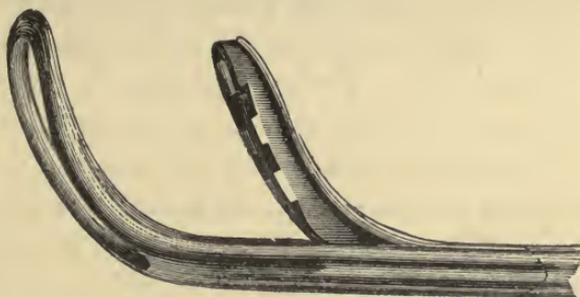


Fig. 49. Fenestrated female blade, with large teeth: a large and powerful Lithotrite.

FIG. 50.

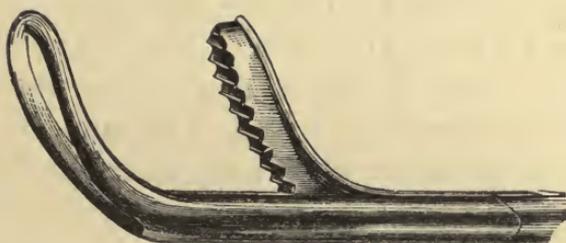


Fig. 50. Fenestrated female blade, with small teeth: rather less powerful than preceding.

The peculiar function of this instrument is to reduce a stone into fragments; it does not pulverize. It is useful for very hard stones, and for all which are of medium and large size; indeed, it is necessary for such at the outset, because instruments of this construction only are strong enough to attack them successfully. As regards the single

attribute of strength, it surpasses all other lithotrites, but it is to be remembered at the same time that it is also, by comparison with others, more dangerous. Its employment requires great care, because the edges of the blades are necessarily angular, and may be sharp ; because these edges meet each other accurately, and the mucous membrane may therefore be very readily included between them ;* because the fragments produced by their action being forcibly driven through a large aperture, are, for the most part, necessarily large, rough, and angular ; and are, therefore, calculated to produce irritation in the bladder. Lastly, the jaws are longer than those of other instruments, and can, therefore, be less readily and less safely turned, or in any way, manipulated, in the vesical cavity.

Class II. The lithotrite with plain or entire blades. (See figs. 51 and 52.)

In this class we have some that are admirable crushing instruments, properly so-called ; some are employed solely for reducing fragments to powder ; and others are merely scoops for the removal of detritus. The first or strongest kind may be used to crush small stones, say nearly all up to about three-quarters of an inch in diameter, if not very hard, and larger ones if friable ; but the special function of this class is to reduce calculous matter, whether existing as small stones, or as fragments produced by fenestrated instruments to a state of powder.

A well-constructed lithotrite, with plain blades, for the purpose of crushing small stones, has a wide female blade, and a narrower male one, so that the force applied through

* Although always made with sharp and accurately-fitting edges, there is no reason why these should not be bevelled ; the accident would then be less liable to happen. This alteration has been recently made, at my suggestion, by Weiss and by Coxeter, and certainly with advantage.

FIG. 51.

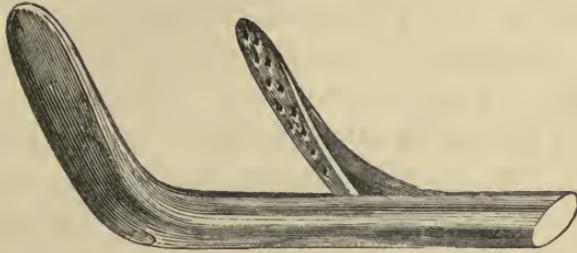


Fig. 51. Lithotrite with plain blades, but the male blade narrow.

FIG. 52.

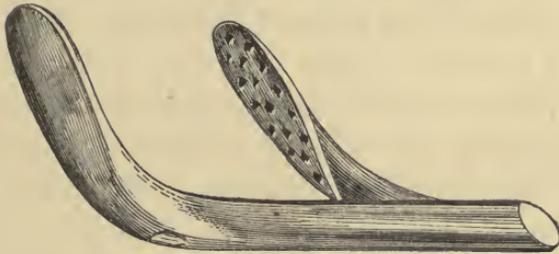


Fig. 52. Lithotrite with plain blades, but the male blade wide.

the latter may act efficiently by its narrow surface, and not be diminished by distribution over a large one. A comparison of fig. 51 with 52 will exemplify this remark. The narrow male blade of fig. 51 will readily make its way through a small stone or fragment lodged against the female blade, the width of which aids in retaining the fragment in position: while the male blade of fig. 52, nearly as wide as the female blade to which it is opposed, will reduce small fragments admirably to powder, but will be inefficient against a hard mass of half an inch or more in diameter. Moreover, were an attempt so to use it successful, the jaws of the instrument might become packed so tightly with detritus, as to render its dislodgement somewhat difficult.

The occurrence of this condition is provided against in the lithotrite with a narrow male blade, from the jaws of which detritus can be always dislodged at the will of the operator, by a method which will be explained when we arrive at the subject of manipulation. But it is important that the female blade should not be too hollow or deeply recessed, especially at the angle, or that part where the blade joins the shaft, since complete dislodgement of débris from this spot is difficult, and its presence here interferes with the perfect action of the instrument. It is a fault met with in too many of the instruments made both here and at Paris. In any case there should be a small hole at the angle to prevent too much accumulation.

The crushing instrument of this class is a very safe and efficient lithotrite where it is applicable, and is possessed of considerable power and strength, although not equal in this latter respect to those of the first class. The margins of the jaws are not sharp but well bevelled; moreover it is scarcely possible, from its construction, to seize or nip a piece of mucous membrane between the edges of the male and female blades, a considerable interval existing between them (the edges only) when the blades are closed. This instrument will also perform the office of a scoop when required, as well as any other instrument made. Its blades being flat, much débris may be contained between them without unduly enlarging the calibre: their capacity in this respect is remarkable. Further, the blades are shorter than those of the powerful fenestrated instruments, and will therefore not easily retain their hold on a stone which is much too large for their power; it will be obvious that the shorter the blades, the more readily will a large stone slip from their grasp as the screw power is applied; so

that they are to a certain extent able to reject a stone much beyond their capacity to crush. Lastly, it may be remarked, that the construction of this instrument, when properly made, provides that if, by any mischance, its power is overtaxed, and fracture of the instrument at some spot is inevitable, this *must* take place at the angle of the male blade (that is, its union with the sliding rod), so that the instrument can be withdrawn, and only a very small portion, not too large to traverse the urethra, will be left in the bladder. There is no more fear of this occurrence, however, if used with prudence, than with any other instrument; still, it is as well to be aware that the thoughtful ingenuity of its inventor has made this admirable provision against possible accident.

Scoop lithotrites are instruments with two blades, of nearly equal size, each of which is more or less hollowed; and meets the other at its edges. With these lithotrites small fragments can be crushed, and débris collected in the instrument, and removed by it through the urethra. Such special scoops are not of very great service.

Thus much for that portion of the lithotrite which transmits the applied force, by direct contact, to the stone itself. The next subject for consideration is that portion of the instrument by which the force is accumulated and applied.

The wheel, and the screw, are the mechanical powers commonly adopted for this purpose; besides these, force can be transmitted by direct manual pressure, and by percussion.

The conditions necessary to the construction of this portion of a good lithotrite are—first, power in abundance; second, power which can be quickly applied, and in small

or large quantity at the will of the operator ; third, power which can be disengaged and re-applied with ease and rapidity ; lastly, all these conditions to be fulfilled, and to be made effective without necessarily producing any harsh movements of the instrument capable of communicating injurious concussion to the bladder or urethra.

The rack and pinion is that form of wheel-power which is now employed, and it is well adapted for many of the requirements in Lithotrity. Its application was originated by Professor Fergusson in 1834, to supersede the original apparatus of Heurteloup. He has employed it ever since, in all sizes and for all purposes ; the most recent model, which is made with great nicety by Mr. Matthews, of Portugal Street, is represented in the adjacent wood-cut (fig. 53).

FIG. 53.

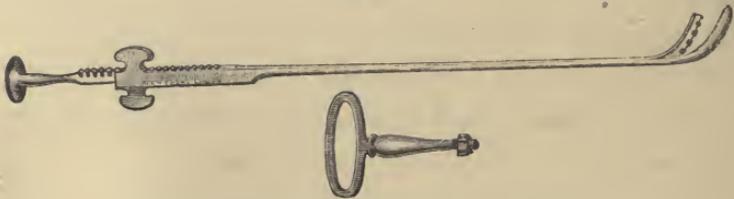


Fig. 53. The rack and pinion Lithotrite: latest model.

Increase in the diameter of the handle of the pinion, increases, of course, the power, and *vice versâ* ; and this diameter should be made to correspond not only with the strength of the blades which have to support it, but with that of the individual by whom it is to be used.

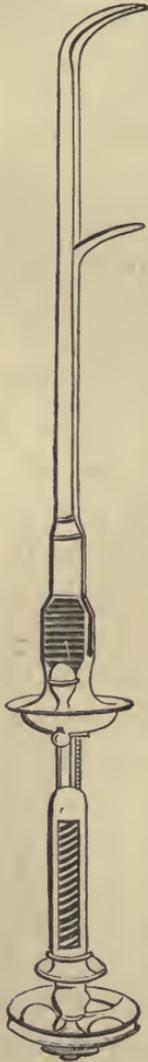
This remark on the relation which the leverage attached to the power ought to bear not only to the resistance at the blades, but to the muscular strength of the operator, applies equally to all lithotrites. If the surgeon has a muscular arm, the instrument-maker will not increase the

diameter of the handle beyond, at all events, an average size : if he is deficient in muscular power, the handle ought to be larger. The rack and pinion is a useful form of mechanical power, because it enables the operator to apply force, when he wishes, by a jerk or impulse,—in other words, *to augment with rapidity the rate of pressure*, an action of which the screw is barely capable ; and this is a kind of force which in some cases tells on the stone when mere uniform screw pressure fails. It stands midway between the screw and direct percussion. It is more susceptible than the screw of being controlled and modified by intelligence, through the medium of the hand, but, unlike the screw, sustained effort is necessary to exert sustained pressure.

The screw is that form of mechanical power which is most commonly employed in the lithotrite. It admits of great pressure being gradually, evenly, and continuously applied. Here the amount of power corresponds with the length of the transverse lever forming the handle of the screw. On the other hand, the quick impulse and percussion are both incompatible with the action of the screw. One great drawback in the original screw instruments (fig. 58, p. 160), and therefore in most of those still used in this country, is the consumption of time by unscrewing, in order to open the jaws of the lithotrite which have been closed in the act of crushing. No matter how often the screw is turned home for this purpose, so often must it be deliberately unscrewed before the jaws can be opened again for a fresh search. Time, as we shall hereafter see, is of great value in Lithotritry, and everything which economizes it, conduces materially to the success of the operation. The abolition of any unnecessary movement is so much clear

gain to the process, since there is necessarily a correspondingly diminished chance of producing disturbance of the bladder. It was long a desideratum to produce a lithotrite

Fig. 54.



in which the screw should remain as the mechanical power, and yet no unscrewing be necessary, in which, also, rapid impulse and percussion could be applied.

The common screw movement, therefore, is mainly applicable, like the rack and pinion, to powerful fenestrated instruments adapted for dealing with large and hard stones or fragments; to perform the delicate operation of finding and pulverizing the smaller fragments, a different mechanism is desirable.

The desideratum referred to has, however, been supplied by M. Charrière, the well-known surgical mechanist of Paris, in the very ingeniously devised lithotrite, commonly distinguished by his name, or by that of Civiale. It is, moreover, the instrument now most generally employed by that well-known lithotomist. (Fig. 54.)

The action provides that, after the male blade has been screwed home, it can be withdrawn instantly to any extent without unscrewing. The movement may be described as follows:—The male blade having been screwed home on a fragment, the operator makes a quarter turn of a movable disc in the handle (fig. 55), when the screw power is

Fig. 54. Charrière's improved Lithotrite.

FIG. 55.

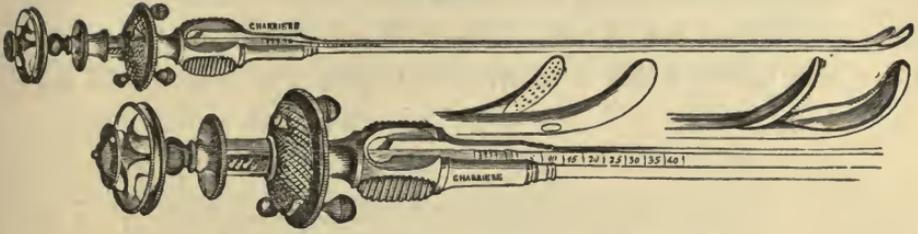


Fig. 55. The handle of Charrière's Lithotrite, showing scale, &c.

instantly detached from the sliding rod and male blade, which may now be withdrawn to the full extent, or moved backwards and forwards in any way, for the purpose of finding a fragment ; when this has been seized, a reversed quarter turn of the disc is made, the screw power is attached, and the fragment is crushed by screwing home. Supposing, however, that the calculus does not readily yield to screw pressure, and there is reason to believe that percussion may be useful, the screw power is again detached without risking the grasp of the fragment, and a smart tap or two made on the end of the lithotrite communicates direct its effect through the male blade. Or, simple manual pressure may be substituted if preferred. The manner in which these objects are attained by this lithotrite is very beautiful, and constitutes a great advance on instruments of the pre-existing construction.

Very recently attempts to improve this action have been made by Coxeter and by Weiss. The former disengages the screw by means of a kind of trigger beneath the handle, which can be done by a finger of the left hand, which holds the lithotrite, and does not require the other hand as in the case of the French instrument. There is also an ingenious contrivance for retaining the stone between the jaws by means of a spring—during the moment of

changing the sliding movement into screw pressure. This instrument can be used either with or without the handle seen below, which is removable at pleasure. (See fig. 56.)

FIG. 56.

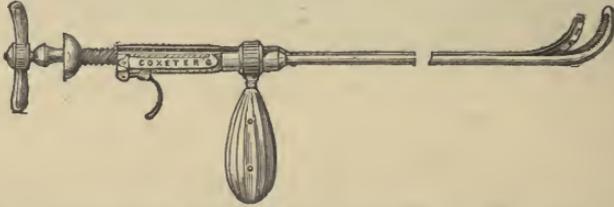


Fig. 56. Mr. Coxeter's new Lithotrite, with handle beneath, which may be removed at will.

The action of Weiss's new instrument is very simple ; a change from the screw to the sliding action can be made by placing on the button (fig. 57, A.) the thumb of either hand without moving it from its hold on the instrument. The cylindrical form of the handle *a, a*, permits a very firm grasp to be made by the operator when steadiness is required ; at the same time it is capable of the most delicate manipulation when held between the thumb and fingers. The movement is adapted both to fenestrated and plain blades. I have used both several times, and am perfectly satisfied with the results : it should be added that it is far lighter than any of Weiss's previous instruments, and also than the French lithotrite of corresponding size.

Other methods of applying power by the wheel, the screw, by percussion, &c., have been employed, but they have, for the most part, become obsolete, and belong now rather to the history than to the practice of Lithotrity, and therefore will not be regarded as coming within the scope of our consideration.

Lithotrites vary in size, according to the purposes for which they are required. Powerful adult lithotrites may

measure in the shaft, about 10 or 11 of the catheter scale, and about 13 or 14, as the mean of the two diameters (lateral, and from before backwards) of their blades. Lithotrites of moderate average power may be equal to 9 or 10 in the shaft, and 12 or 13 in the blades; small ones, 7 or 8 in the shaft, and 10 or 11 in the blades. For boys, 6 or 7 in the shaft, and 9 or 10 in the blades; and the smallest of all, 4 or 5 in the shaft, and about 7 or $7\frac{1}{2}$ in the blades. The two last are not frequently required.

Professor Fergusson has of late considerably diminished the size of the shaft in his rack and pinion lithotrite (fig. 53). There is evident advantage in this, provided strength is not unduly sacrificed; for a slender shaft in the urethra, diminishing the friction of the canal on the instrument, permits greater mobility and freedom to the lithotrite, and favours nice perception in exploring. It would be advantageous I think to extend this principle to the construction of all modern lithotrites, many of which have the shaft unnecessarily large and heavy.

Fig. 57.

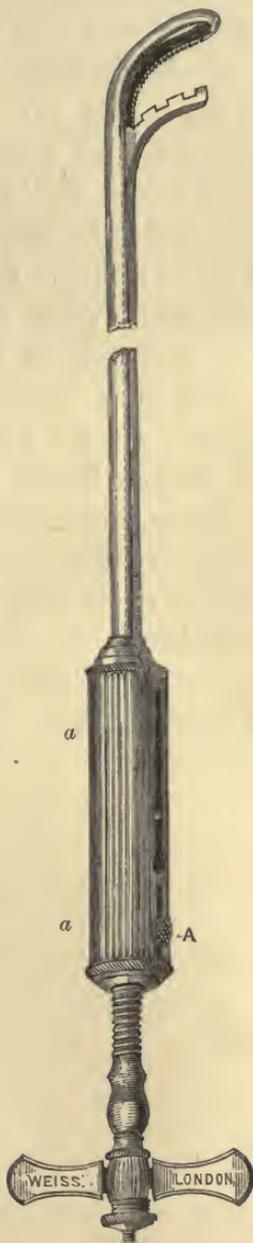


Fig. 57. Weiss and Son's new Lithotrite, described on the opposite page.

All the parts of a lithotrite should work very smoothly and easily, so that the slightest contact with a small fragment can be instantly perceived, a result wholly impossible if the sliding rod does not work with perfect ease and freedom. All lithotrites intended to deal with hard or large stones, should be cut from the solid steel; the best and strongest instruments for this purpose are those of English makers. For reducing fragments and small stones, this costly mode of construction is wholly unnecessary; the shaft may be forged, or formed from a tube which is drawn into shape, instead of being cut from the solid metal. Of this kind none are superior to the lithotrites of the best French makers.

Other instruments used in Lithotrity.

These will be simply enumerated here. Their description will be given hereafter, when their practical application is considered.

Evacuating catheters. Injecting syringe and catheter. Urethral forceps. Urethral lithoclasts.

CHAPTER IX.

LITHOTRITY.—THE SYSTEMATIC APPLICATION OF IT IN THE VARIOUS STAGES OF THE OPERATION.

Position of the Patient ; ordinary and exceptional.—State of the Bladder ;
Injections.—Introducing the Lithotrite.—Finding the Stone ; different
Methods.—Crushing the Stone.

I SHALL now proceed to describe each one of the separate proceedings which are necessary in effecting a single performance of Lithotritry. And in future each application of these proceedings will be denoted by the word "sitting," as equivalent to the French word "séance ;" and the word "operation" will be applied to the sum total of sittings necessary to relieve the patient of his stone.

At the outset it is necessary to consider—

First, the position of the patient during the performance of Lithotritry.

Two positions may be described as necessary in Lithotritry : an ordinary position, and an exceptional or extraordinary. The latter is, however, suitable to a large minority of the cases to which Lithotritry is applicable.

In the ordinary position, a patient lies easily, on his back upon a couch ; which, for the convenience of the operator, should be higher than a common sofa, else he must stoop and be otherwise much constrained in his

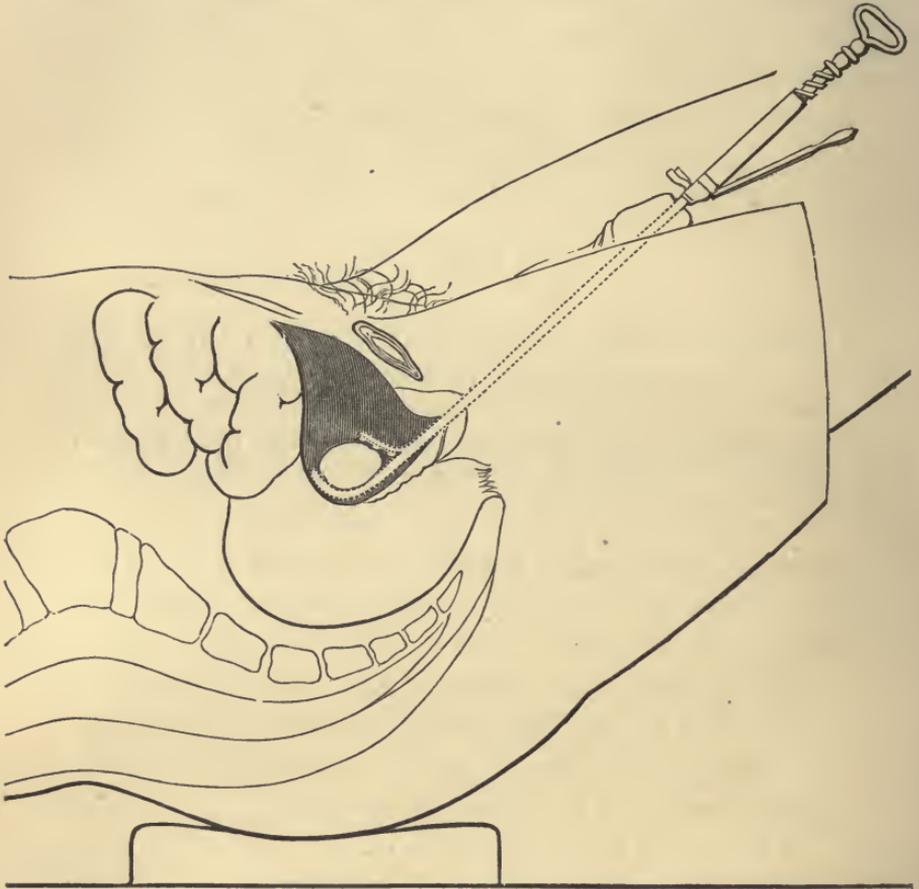


Fig. 58. The first or ordinary position. Common screw Lithotrite, with a stone rather above middle size.

movements. It should be at least thirty inches high ; firm and steady. A bed may be used, provided the patient is placed on a mattress, so that the pelvis does not sink, a position fatal to good practice ; he must be brought with his right side close to its edge ; but a couch or table about two feet wide is better, as admitting free access to either side. The pelvis is to be placed just above the plane of the shoulders, which must remain on a level with the rest

of the trunk, the head only being raised on a pillow : this constitutes the ordinary position. A firm cushion, about two inches thick, should support the pelvis ; an excellent substitute, to be found in any bedroom, is a common pillow rolled up tightly in a towel, which is then fastened by pins.

The thighs are to be separated a little, so that there is a clear interval of about twelve inches between the knees, and each knee may be slightly raised on a small pillow, leaving the space between the legs clear for the operator.

In this position the stone generally lies a little behind the neck of the bladder, and may be easily found and acted on by the lithotrite, provided the bladder and prostate are normal.

In the exceptional position, the pelvis is raised from four to six inches above the level of the shoulders ; a firm cushion of sufficient thickness is placed beneath the pelvis, so as to support the sacrum and tubera ischii. The thighs are slightly raised ; they must not incline from the pubes downwards, or the position of the pelvis will be interfered with. The abdomen, on the contrary, inclines backwards from the pubic symphysis. The stone now lies on the posterior wall of the bladder, at a little distance from its neck, approximating to the upper fundus in proportion to the degree of elevation of the pelvis. This position is generally necessary when there is an enlarged prostate, behind which a stone is frequently concealed ; it is also often desirable when the patient is very stout, and the abdomen protuberant, and in searching for last fragments, or for a small stone, in any case where its presence is suspected, and there has been want of success in a previous search by the ordinary position. It is not so comfortable

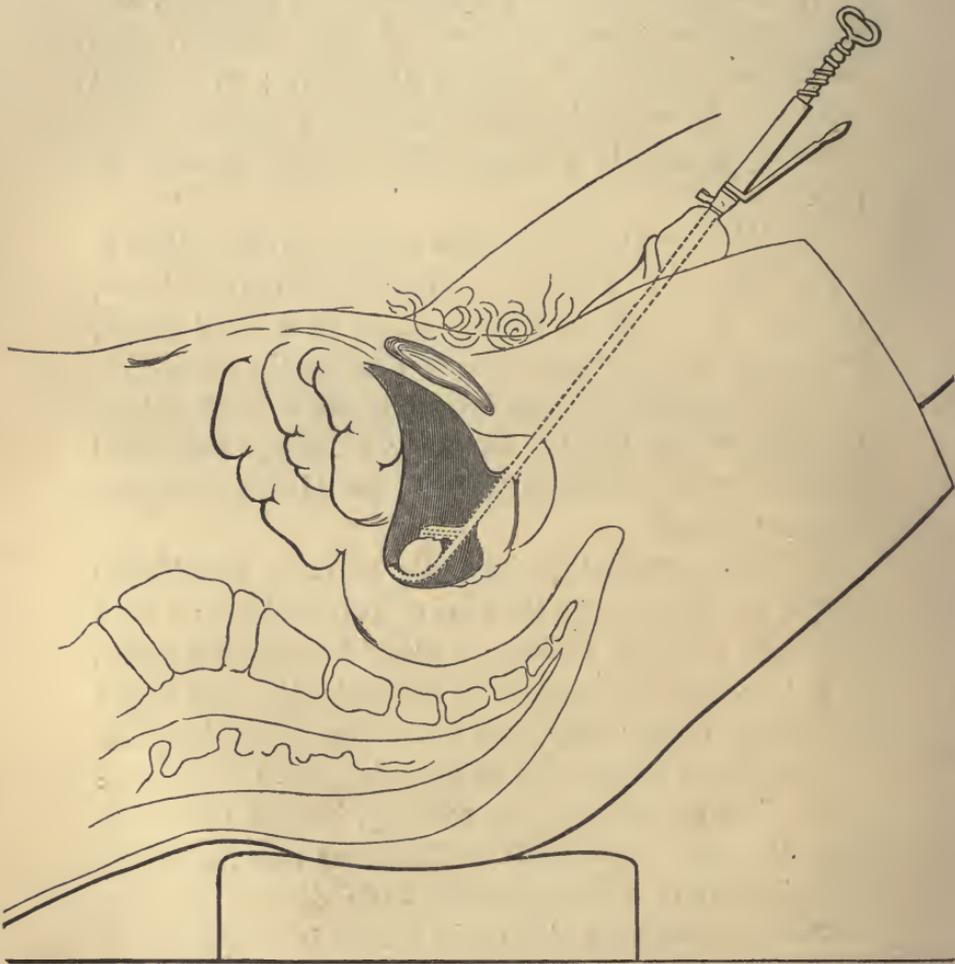


Fig. 59. Second position: prostate enlarged; stone removed by this position to the back of the bladder.

to the patient as the latter, but the sitting should never be long enough to render the position very irksome, much less painful.

Thus it is that a couch, of which the plane can be altered so as to raise the feet twelve or fifteen inches, some-



Fig. 60. The first or ordinary position: enlarged prostate; stone inaccessible in this position.

times meets all the indications with the least amount of uneasiness.

In those few cases in which it may be decided to perform Lithotrity for children, the pelvis should also be a little elevated, otherwise the stone will lie close to the neck of the bladder; the position of this viscus in children rendering that the natural situation for it in the ordinary recumbent posture.

The object of determining the position in Lithotrity is most important; namely, to prevent the stone from lying close to the neck of the bladder, which it almost certainly does if the pelvis sinks a little below the horizontal line of

the body. The centre of the cavity and space beneath it, form the area of opération. The neck, which is very sensitive, easily injured, and ready to take on inflammatory action, is to be kept free from all unnecessary mechanical irritation. An important principle, hereafter to be considered in its place, which is never to be lost sight of in the conduct of Lithotrity.

2. The state of the bladder prior to commencing Lithotrity. Injections.

It is presumed that, by a fair amount of preparation, it has been ascertained that the bladder is not over-irritable, that the urethra is not over-sensitive, and that both have borne the presence of instruments without much uneasiness or any constitutional disturbance. It is also taken for granted that the general condition of the patient is good, or as good as medicinal and regimenal care can make it in his present circumstances, a subject treated in a former part of this work.

It is essential to the safe and successful performance of Lithotrity that the urethra should possess a calibre of at least average size, and that the bladder should be capable of containing a moderate amount of fluid, say from four to six or eight ounces. Less than four is scarcely a safe quantity, inasmuch as the area for working the blades is too small, and their contact with the coats of the bladder is inevitable, unless the object is to employ a small instrument upon small fragments, in which case two or three ounces may be sufficient. A quantity much exceeding eight ounces makes the area of operation too large, in which condition a small stone or a fragment may elude our search, and the movements of the instrument necessary to conduct it are consequently greatly increased, a circumstance which is in

itself an evil. The plan almost universally adopted, therefore, is to withdraw the urine by catheter immediately before operating, and to inject a known quantity, say five or six ounces, of water at the temperature of 100° .

I venture to dissent from this practice, as a rule; although in exceptional cases to be described it is desirable. Sufficient benefit does not accrue from it, to compensate for the advantage sacrificed by not strictly adhering to one of the great principles before enunciated, viz. always to effect our object with the smallest amount of instrumental interference.

As the quantity of fluid required in the bladder may safely range between four and eight ounces, without any disadvantage to the operator, it is in my opinion generally the best practice to arrange that the patient shall hold his urine for a period of one hour, or an hour and a half, the latter if he can, prior to the sitting. This saves the introduction of the catheter, and the sudden distension (sudden as compared with the natural mode) of the bladder with fluid, which exercises always a certain disturbing effect, and excites a disposition in the viscus to contract afterwards. The sitting is commenced with the introduction of the lithotrite; while the patient is saved all preliminary instrumentation, and the excitement and uneasiness arising from it. Besides, in this manner, the entire term of the sitting is shortened nearly one-half.

If the patient cannot retain his water more than twenty or thirty minutes, he usually requires more preparation; since, if an attempt is made to compel the bladder to retain a larger quantity than it tolerates comfortably, uncontrollable contractions of it are produced, pain is occasioned, and the organ is at once placed in an unfavourable con-

dition for Lithotrity. It is useless to contend with the bladder; and any contest engaged in will certainly end in the discomfiture of the operator. The organ must be coaxed into obedience, not forced.

The exceptional cases in which it is generally desirable to inject the bladder are those in which there is atony of its coats, or "paralysis" as it is popularly, but not very correctly, termed. That condition of the coats of the bladder, which is most favourable to Lithotrity is one of healthy tonicity, a condition in which the organ contracts upon its contents sufficiently to form a reservoir of tolerably regular form. An abnormal irritability, or disposition to contract, is objectionable on the one hand; a flabby, unexcitable state of the coats is unfavourable, although in a less degree, on the other. It is so, because the stone is apt to be partially enveloped, it may be, hidden in loose folds of the bladder; because the viscus, in place of forming by its inherent tonicity, a somewhat ovoid figure, is influenced rather by the pressure of surrounding viscera, and may take any irregular form which they determine. Such a condition is temporarily improved by the stimulus of injection. The urine is withdrawn, a known quantity of water is injected, and if it is much cooler than the blood, say at 70° or 60°, the stimulus to slight contraction is usually increased.

The want of tonicity in a bladder presents a state of things which resembles very greatly the condition of the bladder in the dead subject. Useful as the practice of Lithotrity is on the subject, in relation to the manipulation of instruments, it should be remembered that the condition of the bladder is different from that which exists in the healthy living body. In the dead body the stone does not

lie at the neck of the bladder, but falls anywhere in the flaccid viscus, which position, and the pressure of adjacent viscera, render the lowest. By depressing the jaws of the lithotrite into the *bas fond*, after the system of finding the stone much adopted in this country, the stone of course rolls into it. But this result is by no means a matter of course in the living. When tonicity is active, there is a constant tendency in the muscles of the bladder to roll a large stone towards the neck, a fact of importance, and the result of this action, though much modified by the position of the body, is by no means altogether counteracted by it.

3. The mode of introducing a lithotrite.

This varies materially from that by which a catheter is passed into the bladder, and it is important that the difference should be explained and observed. The difficulty frequently encountered in introducing the lithotrite is generally due to ignorance or neglect of the distinction existing between the two operations.

In catheterism, a smooth continuous curve or sweep is made from the external meatus into the bladder. Throughout the entire movement, the instrument passes through a series of continuous curves; the shaft of the catheter at first horizontal (supposing the patient to be recumbent) is gradually moved upwards to the perpendicular, and downwards to the horizontal again, in a direction precisely opposite to the first position.

In passing a lithotrite, the continuous sweep will not be successful in carrying it into the bladder; the terminal angular part constituted by the blades would thus be brought into hazardous contact with the upper part of the urethra before the pubic arch is passed. On the contrary,

the shaft of the lithotrite must be maintained in one position for a considerable part of its course. This will appear in describing the movement in detail.

The operator places himself on the right side of the patient, and stands with his back towards the head of the couch, with his left side to the patient's right. Having warmed and well oiled the lithotrite, he holds it lightly with his right hand, in a horizontal position, the blades pointing downwards, and raises the penis with his left ; and as he introduces the blades into the urethra, the left draws gently the penis over the angular end of the instrument, which descends in this manner down to the bulbous portion of the urethra, the shaft rising gradually towards the perpendicular. Having arrived there, it is not now to be depressed as in catheterism, since this movement raises the point of the blades against the roof of the urethra in front of the deep fascia above the narrow orifice of the membranous portion, while the large capacity of the bulbous urethra favours the malposition described, and, if force is used to overcome the difficulty, laceration will probably take place. This, indeed, is the accident which, more commonly than any other, happens in the hands of beginners, or with those who are not aware of the proper course to be pursued. In order to pass the blades easily and safely through the narrow membranous portion, it is necessary to maintain the lithotrite a few seconds at the perpendicular, permitting it to progress slowly in that position. This proceeding is accomplished by permitting a part of the weight only of the instrument to act as the propelling power, while the penis is drawn upwards, a little, in the same, that is the vertical, direction. In this position the blades slide through the bulbous portion, enter and traverse

the membranous portion, and arrive at the prostate. Then, and not before, the operator gradually depresses the instrument towards the patient's thighs; the blades rise up through the prostatic portion into the bladder, a movement which is rendered more easy if a very slight lateral rotary motion is given to the instrument at this part of its progress. At the same time the fingers of the left hand may be gently pressed on the pubic symphysis to relax the suspensory ligament of the penis; at all events the disagreeable sensation of strain upon it experienced by the patient at this moment is relieved by so doing, and the movement onwards of the instrument is facilitated, especially if the shaft has to be much depressed to surmount any obstacle at the neck of the bladder. In ordinary, that is normal, conditions, the shaft of the lithotrite at the entry into the bladder forms an oblique line and an angle of about 20° to 30° with the horizon; and this it continues, as it slides easily and freely down upon the trigone to the posterior wall of the viscus. It will be obvious that the urethra now entirely loses its curve, being occupied throughout by the straight shaft of the lithotrite.

The angle which the blades form with the shaft varies, as has been already seen; in some the blades describe a curve from the shaft to their points. The more angular, however, the union between the blades and shaft, and the smaller the angle so described by their axes respectively, the more necessity is there for following the directions just given.

For those who prefer it, the instrument may be passed on the patient's left side, as in catheterism; but, if so, the operator must afterwards go round to the right side to perform the operation of crushing. It is, however, equally if not

more convenient to introduce it on the right side, in which case time and movement are economized to a slight extent.

4. To find and seize the stone. — This is a very important subject, and about which there has been no little discussion, since practical men have been divided in their opinions respecting the course to be followed.

It will be supposed here that the lithotrite of Charrière (fig. 54) has been easily introduced, and that its blades have passed into about the centre of the vesical cavity. The proper method of holding the instrument is the first step to be considered, since the facility with which the operation is performed will much depend on the system of manipulation adopted. The surgeon should be completely familiarized with the lithotrite, and with the best position and action for his hands upon it, long before he ventures to operate in the living bladder, so that he may instinctively hold and manage the instrument according to the rules laid down, and has not to recall them to his memory at that moment. Without doubt, the best method with the existing lithotrites has been ascertained by practice and observation ; viz. that which enables the operator (bearing in mind our guiding principles) to exert the largest amount of influence on the stone, with the smallest amount of disturbance to the bladder. Even supposing this were not the case, it would be advantageous to the operator to practise one method as the rule, and so acquire a facility in the use of the lithotrite, which practice by an uniform method alone can impart ; but it is doubly so in the circumstances just stated.

First, the manner of holding the lithotrite of Charrière.

The handle (or thick end of the shaft) is to be held between the thumb and fingers of the left hand, the thumb

applied to a knob attached to the disc, the index finger to the other knob attached on the farther side; the second and middle fingers are applied to the handle close to the index finger: the little finger may be free or applied; where ease of movement is wanted, as in searching, it is free; where steadiness and immobility, as in crushing, it is applied. The pulp of the thumb is brought into contact with the knob, the last or distal phalangeal joints of the fingers are the parts which come into contact with the opposite side of the handle (fig. 61). Held lightly, but

FIG. 61.

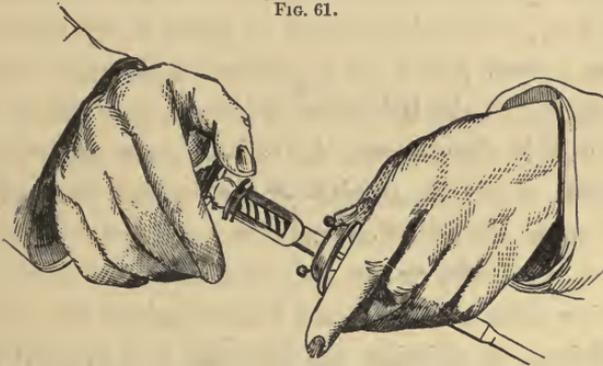


Fig. 61. Position of the hands in searching with the Lithotrite of Charrière.

firmly, in this manner, the thumb and index command and control easily the movements of the instrument, and can incline the blades right or left, with very little movement of the hand itself, and, *à fortiori*, without any change or shifting of its hold on the instrument.

The right hand is free to open and close the blades, to turn the movable disc which converts the sliding into a screw action, and *vice versa* (see page 154), and to screw home the male blade for the purpose of crushing the stone. The position is faithfully represented in the adjacent drawing (fig. 61). The left hand holds the handle in the manner

described, while the right, holding the wheel end of the sliding-rod, is in the act of withdrawing it, and so opening the jaws of the instrument.

Now, what is the first proceeding in order to find and to seize the stone ?

There are two methods now in vogue, differing from each other in principle, and necessarily differing also in the details of execution. The first mode, or that which has been commonly adopted in this country, is attributed to Baron Heurteloup, and was employed by Sir B. Brodie. It consists in depressing the blades on the posterior wall of the bladder and endeavouring to make it, by gentle pressure, its lowest part ; on withdrawing the male blade the stone falls into the lithotrite, it is said, four times out of five. "If it should not do so"—I now quote the precise words of Sir B. Brodie—"the forceps, without being moved from its situation, may be gently struck with the hand on one side, or on its anterior part, and the slight concussion thus communicated to the bladder, will probably be sufficient to dislodge the calculus, and bring it within the grasp of the instrument. If it should be otherwise, the forceps being closed, may be very gently and cautiously turned to one side or the other, so that the curved extremity of it may make an angle of 25° or even 30° with the vertical line of the body, then opened and pressed in the direction of the rectum in the manner already described."*

The principle of this proceeding is, *to place the crushing instrument in a position presumed to be advantageous, and to bring the stone to the instrument in almost any way, rather than apply the instrument to the stone.*

The other mode is that of Civiale. Its principle is the

* Trans. Med. Chir. Soc., vol. xxxviii. p. 174.

reverse of the preceding. By position of the patient, the centre of the bladder and space beneath it are selected as the area of operation; no depression is made; contact between the walls of the bladder and the instrument is, as much as possible, avoided. The instrument is applied to the stone in the situation which this naturally takes, and the operator carefully avoids moving it, or any movements of concussion whatever, however slight. It is only due to the distinguished operators first named to say that this, the modern, and it is believed the improved, method, is in part due to the mechanical improvements which have been made in the lithotrite of late years. The method was scarcely possible until the present instruments existed.

We shall now consider it in detail. The blades having entered the cavity of the bladder, the instrument slides easily and smoothly down the trigone, which in the living and healthy organ is an inclined plane, although quite otherwise in the atonied and in the dead bladder.

In many cases the stone is grazed by the instrument as it passes, and the slightest lateral movement of the blades, right or left, will determine on which side it lies. If so, the operator is careful not to disturb it, but he inclines the blades *slightly away from the side on which it lies*, carrying the instrument gently in towards the posterior wall of the bladder, while the male blade is slowly withdrawn. It is important always to bear in mind, that as long as the blades are near the neck of the bladder, the male blade cannot be withdrawn, since it would impinge on that sensitive part and cause pain or injury. Having done so he now inclines the well-opened lithotrite towards the stone, slowly closes, and almost certainly seizes it.

But suppose no stone was felt on entering, he is then

directed simply to withdraw the male blade an inch or more in the middle line, to incline the blades to the right side about 45° , and then to close them, without altering the axis of the shaft, or otherwise disturbing the central position of the instrument. Thus in almost all positions the stone is seized sideways by the blades of the lithotrite, and very rarely by their extremities. If no stone is felt, he turns them, opened, to the left in a similar manner, and then closes them. Observe, that the blades are always to be opened before they are turned, for this reason : if the turn is first made and the blades are subsequently opened, the chance is that the male blade as it is withdrawn will move the stone away ; whereas if the blades are inclined while open, the stone, if there, is almost certainly seized. This is one of the many apparently minute but extremely important points of which systematic Lithotripsy is made up. To return : it is very rare that the stone will elude the search thus far, but if it does, depress the handle of the lithotrite half an inch or so, which raises the blades very slightly from the floor of the bladder, and turn them another 45° to the left, bringing in fact the blades horizontal to the left ; close ; if unsuccessful, turn them gently to horizontal on the right, and close. These five positions (vertical, right and left incline, right and left horizontal) explore the bladder fully, middle, right, and left, and will almost certainly find any stone of moderate size in a healthy bladder. The object is at the same time strictly to avoid communicating any jerk to the instrument or to the bladder. In all these movements, if properly executed, there has been barely contact of the lithotrite with the vesical walls, at all events no pressure, nothing to provoke undue pain, or cause contractions of the

bladder. If, however, there is an enlarged prostate, causing an eminence at the neck of the bladder, a depression behind it, or the stone is very small, or we are exploring for some fragment, at the close of the case, which is suspected to have eluded previous search, the blades may be reversed so as to point downwards to the floor, and the object sought may then often be secured with ease. If seeking for a small stone or for fragments, we shall employ a lithotrite with short blades, which can therefore be reversed with much greater ease than one with long blades.

In order to do this properly in the normal bladder, the handle of the lithotrite is depressed another inch or so, between the patient's thighs, so that the line of the instrument, instead of being directed obliquely a little upwards, is level with, or even points a little below, the horizon; the blades, supposed to have been already brought to the horizontal as before described, are cautiously turned, about 45° say, to the right (right reversed incline), so as to point obliquely to the floor, which should be barely felt, or very lightly touched by them. No pressure should be made on this part of the bladder by any part of the instrument, and it is easily avoided by depressing sufficiently the handle of the lithotrite. Then close the blades; next, turn them back, that is upwards, over to the left (left reversed incline); and close. Lastly, they may be brought round, to the reversed vertical position, and the floor lightly swept: this requires the maximum depression of the handle, and is only necessary to pick up small fragments with a short-bladed instrument (fig. 62). But when the prostate is considerably enlarged, and a stone or fragments have to be sought behind

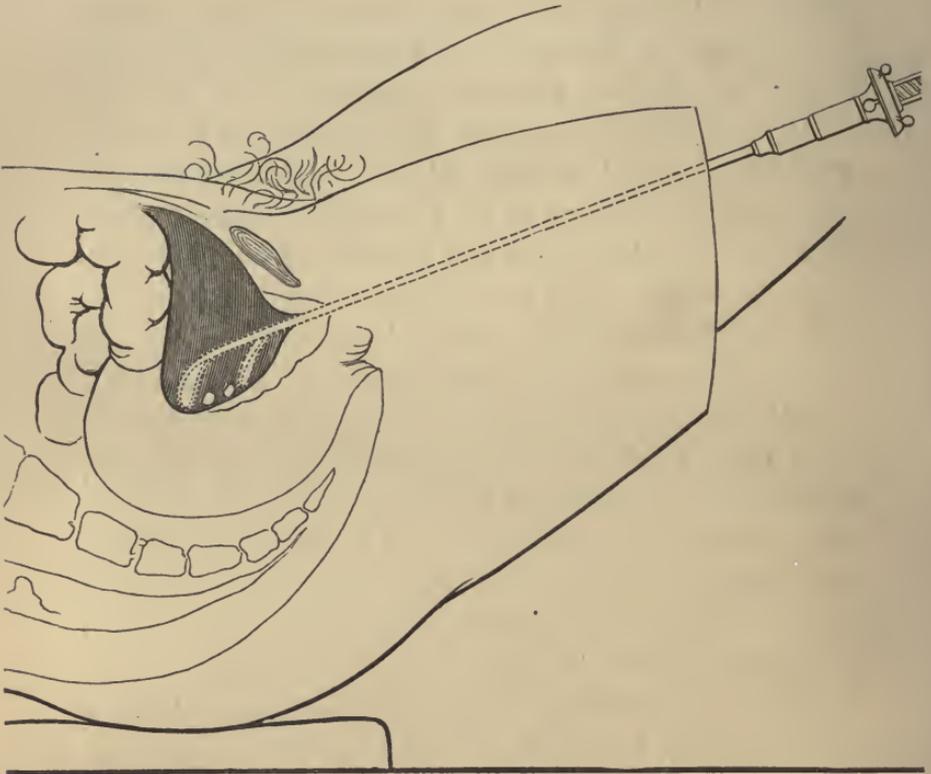


Fig. 62. First position: lithotrite with short blades reversed to crush fragments. The handle is not sufficiently depressed in the drawing: it comes to the horizontal, or even inclines below it sometimes.

it, the lithotrite is reversed without depressing the handle. (fig. 63).

All these movements are to be executed at or beyond the centre of the vesical cavity, the proper area for operating, without hurry, rapid movement, or any other which partakes of the nature of a jerk or concussion, and, if in a fairly healthy bladder, without causing more than a very slight degree of pain to the patient. The operator's eye is also to be so familiar with the scale marked on the sliding-rod, that

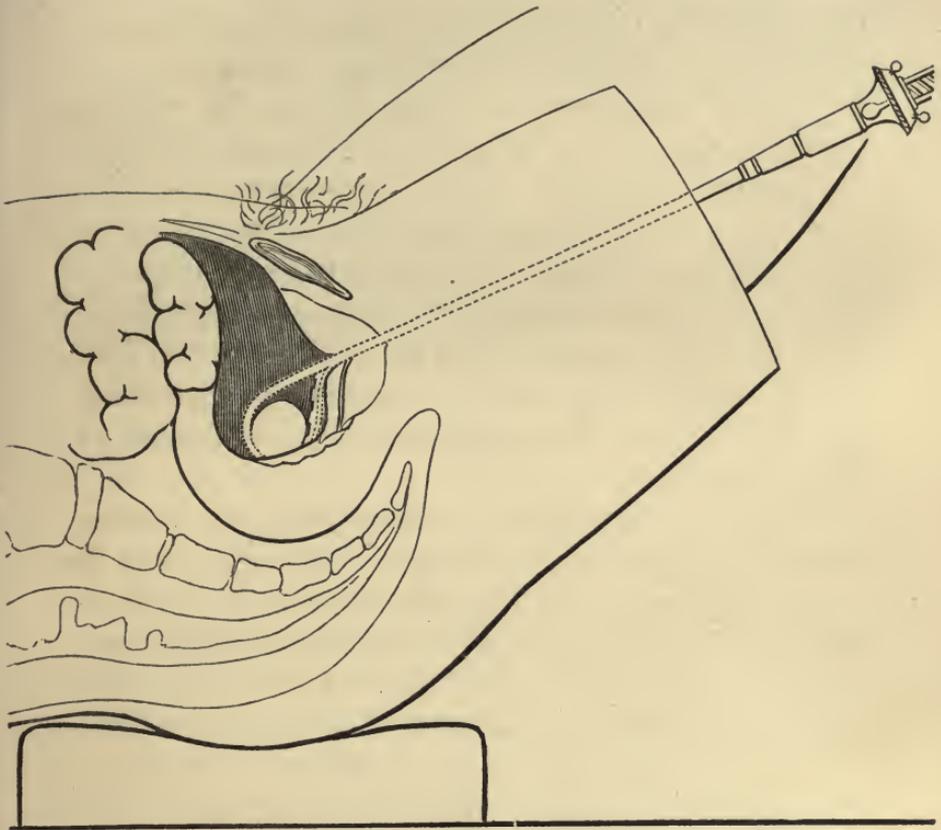


Fig. 63 Second position: enlarged prostate; Lithotrite reversed to seize a large stone.

he knows at a glance the exact interval which it indicates as existing between the blades in the bladder.

It is essential to good practice, while manipulating the lithotrite, to maintain the axis of the instrument, as far as possible, always in the same direction. The blades only are to be moved, the shaft should occupy the same inclination, unless when this is intentionally altered. In screwing home the male blade, the operator is very apt to move the lithotrite also, at each turn of the screw, unless he is conscious of the care necessary to avoid this evil. All lateral movements, all vibration and concussion, necessarily tell on the neck of

the bladder and prostatic urethra, where the instrument is most closely embraced, and its mobility is most limited. To that part of the lithotrite which occupies the anterior portion of the urethra much freedom of lateral movement is permitted, and in the bladder the instrument is free, although in a less degree ; but the axis, or fixed point, as regards lateral movement, is at the part indicated, which is also the most sensitive spot of the entire passage. Hence the aim of the operator should be to produce in this situation no motion of the lithotrite except that on its own axis. Few of the details of the operation require more practice to master than this.

There is one important rule with reference to the situation of the calculus in the bladder. The larger it is, the more certain it is to be found lying near to the neck of the bladder in the ordinary recumbent position, while a small one is usually detected at the back of the trigone. This position of the large stone requires a different method, and it will be found almost invariably successful. The moment the lithotrite enters the bladder it is not to be pushed onwards to the bottom of the cavity ; first, let the blades be inclined away from the side on which the stone is felt, then push on the female portion of the instrument only, by itself, as far as it will go, maintaining the male blade at the neck of the bladder ; it is now only necessary to incline towards the stone, and it will be seized almost certainly at once. But if the operator commences by pushing on the whole instrument, and then withdraws the male blade according to the ordinary custom, this blade is infallibly drawn against the large stone, which it therefore fails to catch, and presses it back against the neck of the bladder, producing pain, irritation, and perhaps bleeding ; this is a

practical rule of importance. As already intimated, for a small stone, the instrument glides down to the posterior wall of the bladder, the male blade is withdrawn, and the stone caught in the usual manner.

Such, then, in the main, is the method of Civiale for finding the stone; the other, or English method, is without doubt an efficient one, but I believe it to be more irritating to the bladder, and less certain for removing every minute fragment towards the end of the operation, while it fails to deal efficiently with a stone lying behind an enlarged prostate. Hence the crushing operation has been often said to be inapplicable when such disease exists, a conclusion wholly unwarranted by the practice and results of modern Lithotripsy. Having tried both methods myself, I have no hesitation in preferring the former.

The rules already laid down for finding and seizing, hold good with the common screw, and with the rack and pinion lithotrites, this general rule applying invariably to all instruments; viz. the more powerful the lithotrite, that is, the larger and longer are its blades, the less readily are we to adopt the horizontal, and still less, the reversed positions of the blades; the more fluid also is it necessary to have in the bladder. As the long and fenestrated blades are used chiefly for the initial act of breaking up a large stone into fragments, it is obvious also that there is less occasion for the horizontal and reversed movements, since a large stone may almost certainly be seized by the right or left incline. The rack and pinion lithotrite can be used with much less movement and change of hand than the common screw. It is held firmly with the left hand, while the pinion is worked with the right. (See figs. 64 and 65.)

The common screw lithotrite requires more change of

Fig. 64.

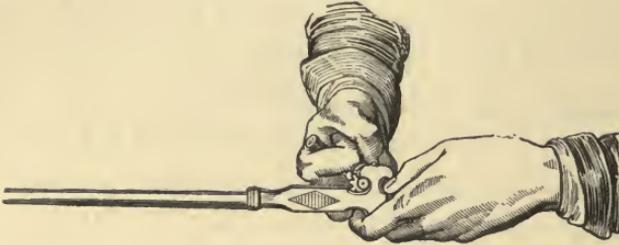


Fig. 64. Mode of holding the rack and pinion Lithotrite; Mr. Fergusson. By permission, from the "Manual of Surgery," p. 793.

FIG. 65.

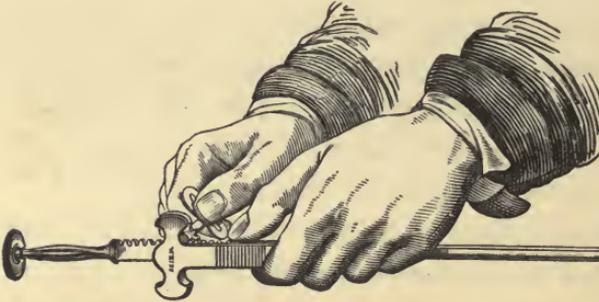


Fig. 65. Mode of holding the rack and pinion Lithotrite; Mr. Fergusson. By permission, from the "Manual of Surgery," p. 793.

hand than either of the others. No specific directions can therefore be given in writing which could be of any service. Any operator who prefers to use it should study it well with a view to economize movement as much as possible.

5. The manner of crushing the stone when seized.—Supposing that a hard stone of an inch or more in diameter is in the grasp of the lithotrite with the fenestrated blade, which, it will now be understood, is the only instrument with which it is safe to commence an attack on it, the screw is to be gradually turned at first, to make the blades bite, since a sharp turn at this moment is likely to drive the stone out either right or left. As the power is increased, which is still to be done slowly, the resistance is felt to

relax, sometimes by degrees, sometimes suddenly with a crack, and the stone is broken usually into four or five large pieces, besides some small débris. This being done, the male blade is again drawn out, taking care not to shift the situation, or alter the axis of the lithotrite. The blades are merely turned to the right or left incline, and, almost certainly, one of the large fragments which fall to the floor of the bladder, and lie just beneath the extremity of the instrument, will be picked up. It is then desirable to raise slightly the blades and their contents from the floor, and screw home as before. This process may be repeated two or three times, *if the instrument is worked at the same spot, and the patient maintains his position.* Since the area within which the larger fragments fall is very limited in extent, and remains unchanged if these conditions are complied with, there is no difficulty whatever in finding the fragments readily, provided the operator is content to work in the centre of the bladder, above its most depending part, as determined by the position of the patient, and not to change the place either designedly or unwittingly. The large and heavy pieces fall invariably in the same place, and may be picked up again and again, if this simple rule of keeping the blades in one place is adhered to. Having now broken-up the stone, and, say, crushed two or three times the largest fragments, enough has been done for the first sitting. At all events, the lithotrite should not remain in the bladder more than three or four minutes, which is ample to produce the result described. The patient should at once be warmly wrapped up; a hot bottle put to his feet; while a hot napkin, or a flannel wrung out of boiling water, applied to the perineum

and hypogastrium, have a soothing effect, and diminish any wants to make water which may be present, and which it is best to discourage for a short time, and he should rest quietly on the couch, or on a bed adjacent. During the first twenty-four hours, at least, after the first sitting, with a stone of the kind described, the patient should pass his water as he lies on his back : the large angular fragments are in this way prevented from being driven too forcibly against the neck of the bladder. It is because these characters are more marked after the first fracture of the stone than after later sittings, that it is desirable, as a rule, to take every precaution against irritation, local and general, after the first crushing or two. On no account should the bladder be injected or washed out after the first sitting ; in the first place, because it is on this occasion particularly desirable to avoid unnecessary irritation ; and, secondly, because the first object being mainly to make fragments, no great amount of small detritus capable of removal, would probably be found. Here, as on most occasions, the following maxim will be found a judicious one : calculous matter, in a state of powder, will come away of itself more easily than you can remove it ; fragments, too large to pass the urethra, will remain behind, do what you will ; fragments small enough to pass with some difficulty should be left to take their chance at first, since, if the bladder is unduly irritated by repeated instrumentation for their removal, some of them will be driven by its involuntary action into the neck of the bladder and urethra with violence. On the other hand, if the bladder remains quiet, they will, probably, not pass until, after a day or two's sojourn in the viscus, their sharpest angles have been

worn down a little, when they may be trusted to find their own way safely enough. A meddlesome disposition is not less prejudicial here than in any other department of surgery. If crushing is properly practised, we shall act wisely in mainly committing to nature the task of removing the product. Over haste, or undue anxiety to see or to display the results of our work, both tend to defeat the ultimate success of the operation.

CHAPTER X.

LITHOTRITY, ITS SYSTEMATIC APPLICATION CONTINUED.

The Crushing and Removal of Fragments.—Various Modes of Discovering and Crushing the last Fragments.—Treatment following the Sitting.—Impacted Fragments.—Fever.—Cystitis.—Inflammation of the Kidney and Orchitis.—Hæmorrhage.—Retention.—Administration of Chloroform.—Lithotrixy in Children.—Recapitulation of Directions for the Performance of Lithotrixy.

6. THE crushing and removal of Fragments.—Supposing that, thanks to our management and care, no signs of local irritation, and no bleeding, or only a trace of it, have appeared, and no fever has occurred, it is desirable very soon to deal with the fragments. After a period of from four to six days, according to circumstances, we should, unless the stone has proved so hard or so large as to require another application of the fenestrated instrument, commence the second sitting by introducing an improved screw lithotrite with strong plain blades, of which the male is much narrower than the female blade (fig. 51), the urine being retained for an hour or an hour and a half previously, as before advised. As the fragments are now large, and, probably, several in number, simply opening and closing in the first position, or in the right or left incline, will almost certainly secure one at each attempt, and enable us to crush it into smaller fragments, making at the same

time a fair proportion of fine detritus, a good deal of which generally becomes impacted between the blades of the lithotrite. Some of this may be withdrawn, but it is always desirable to diminish the quantity before removing the instrument, inasmuch as, being powder, it is sure to come away easily enough during subsequent micturition; and there can be no necessity to irritate the bladder or urethra by withdrawing the blades largely impacted. By adopting the following manœuvre, almost all their contents may be removed at will. The blades are to be carried to the centre of the bladder, the instrument is grasped firmly by the left hand, while the right screws the male blade as near home as it will go, and then makes numerous alternate turns of the screw, one turn out and one in, somewhat rapidly: this movement will work the impacted débris out of the female blade on each side of the narrow male blade. This proceeding is practicable only with an improved screw instrument in which the male blade is narrower than the female, and it is one of the important purposes contemplated by the construction described, and forms one of the advantages of the instrument. If it is clear from the sensation acquired during the crushing that this has been very effective—that numerous small fragments have been made; if the patient has exhibited no undue irritability or disposition to fever after the previous sitting, an evacuating sound may be introduced (figs. 68, 69, 70), the bladder emptied, and six or eight ounces of warm water rapidly thrown in, while the patient is in the upright position, and permitted to run out instantly in a full stream. Some quantity of débris may be removed in this way; often, however, it is otherwise, most commonly indeed the main quantity does not come away until thirty-six or forty-eight hours after the sitting,

and then by the patient's natural efforts in micturition. And in the majority of cases it is desirable to keep the patient chiefly in the recumbent position until the débris has passed.

It is quite possible to remove by the lithotrite, especially with the instrument used at this stage, or with what is called "the scoop," a large proportion, or even the whole, of the calculous débris, instead of permitting it to come away by the natural passage. It is a proceeding, however, not to be advised, as a rule, and for the following reasons. First, nothing is gained by so removing it; all the débris which can be impacted between the blades of an instrument being in a state of powder, or nearly so, can come away by the urethra quite easily without such aid. Secondly, the risk of over-distending and scratching the urethra, together with the serious consequences which these accidents often entail, is increased by this proceeding. Unless the bladder fails altogether to expel the débris, and washing out by means of the evacuating sound proves inefficient, which can very rarely happen, there is no occasion to introduce an instrument repeatedly, and repeatedly withdraw it loaded with débris. Thirdly, the impaction of fragments in the urethra is subsequently much more likely to take place, if any laceration of the canal has been occasioned by withdrawing débris. Indeed troublesome impaction of fragments does not very often occur unless the urethra has been previously injured in some way.*

The succeeding sittings may usually follow at intervals

* Sir B. Brodie writes on this subject as follows:—"There are, however, some very grave objections to this mode of proceeding. The withdrawing of the forceps, if much loaded with calculous matter, stretches the urethra beyond its natural diameter, and, in so doing, not only gives the patient much pain at the time, but renders him liable to rigors afterwards; secondly, in four instances in which I had

of from five to seven days, unless difficulties have arisen ; and the kind of instrument employed must depend on the size of the fragments we have to deal with, and these, of course, will depend on the original size and texture of the stone. If there are now many small fragments remaining in the bladder, but too large to pass, a condition always likely to be present after two or three crushings, it will be advisable to employ the lithotrite with a wide male blade (fig. 52), but constructed in all other respects similarly to that last used. With such an instrument it is scarcely possible to fail of picking up small fragments on each time of opening and closing, and on each crushing these will be chiefly powdered by the action of its flat blades ; while not only the right and left incline, but the right and left horizontal positions, will be advantageously available in its use. When the fragments are small, it is not necessary always to screw up the male blade in order to crush them ;

adopted this practice the urethra was torn, and an infiltration of urine into the surrounding tissues, followed by urinary abscess, was the consequence. Two of these patients in whom the mischief produced was deep in the perineum, died, notwithstanding the abscesses having been freely opened as soon as they were detected.”—Med. Chir. Trans. vol. xxxviii, p. 175. Notes on Lithotrity.

In relation to the occurrence of infiltration of urine, and abscess after Lithotrity, Mr. Charles Hawkins thus expresses himself:—“ He believed this accident might be entirely avoided, if the operation of crushing be performed with the lithotrite,—that is, if the operator is satisfied with crushing in the instrument, and not attempting to withdraw the fragments between the beaks of the instrument. He believed this accident never occurred except where the urethra had been lacerated with a piece of stone during the withdrawal of the instrument ; then impaction of a fragment led to the results which the preparations exhibit ; but where the urethra has not been lacerated, impaction is of little importance, and no dangerous symptoms are likely to result from such an occurrence. . . . Since no attempts have been made to remove fragments from the bladder in the instrument, he had met with no such accident. . . . As far as his experience went, it was not necessary to attempt the removal of stone in the scoop-lithotrite. If the stone is *well crushed*, it may be left to nature for the bladder to be evacuated of the fragments, or where there was a difficulty in passing them, he had removed much by means of washing out the bladder.” . . . —Path. Trans., Part I. of vol. iii. 1850, pp. 123-4.

it suffices simply to press it closely home by manual power, a method adopted by some. The screw, however, is smoother in its action, admits of no jerk or concussion, and I prefer it on this account. If a fragment falls between the blades which the scale upon the sliding-rod indicates to be too large for the power of this instrument, it has only to be rejected, and smaller ones found and crushed. In three or four minutes a considerable quantity of powder will be made by a judicious application of this instrument to the smaller fragments, and this may be safely left for nature to expel. These processes are now to be conducted on the principles laid down, and repeated until the stone has nearly disappeared.

7. Removal of the last fragments.—This is an extremely important crisis in the operation, and one which it is important not to neglect. It sometimes demands more skill, and nicer manipulative power, than any other part of it.

Supposing that after four, five, or six sittings, or more if the size of the calculus has demanded them, it has become obvious that very little calculous matter remains in the bladder, we have now to take care that the last fragments are entirely removed. As long as any remain, there will almost invariably be pain in passing water, especially at the close of the act, while the urine may be cloudy and often tinged with blood, and quick movements of the body give pain. As long as these symptoms persist we may be assured some portions still remain behind, and these must be found. The best method of proceeding is to introduce, as before, an improved screw lithotrite with plain blades, taking care to have only a small quantity of water in the bladder, say about three or four ounces. The best form for the purpose is that in which the blades are short and

their ends not tapering or in any degree tending to a point. The form represented by fig. 66 is greatly preferable for

FIG. 66.

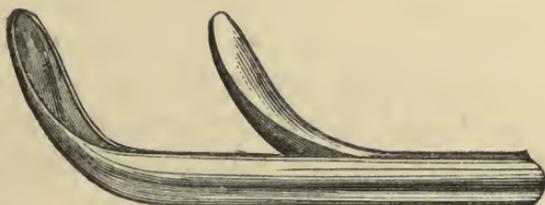


Fig. 66. Lithotrite with short and wide plain blades for small fragments.

this purpose to that of fig. 51, p. 149. If by the ordinary positions of the instrument we encounter no fragment, the handle must be a little depressed between the patient's thighs, as directed for the reversed positions at pages 175-6, and these positions of the blades employed. It will now be seen why the pointed blades are objectionable, as being more likely to irritate the floor of the bladder, and less likely to catch the fragment. A careful search in the right and left reversed incline, and in the reversed vertical position, will generally discover its object; if not, the patient's pelvis is to be raised about four inches, that is, to the exceptional position, when with care and perseverance the fragment will be caught and crushed. This sitting requires sometimes a little longer time than usual; it should never extend, however, beyond five minutes. If not successful, then it is better to wait a few days, and to try on the next occasion a slight deviation in the position of the patient, as from the back to reclining a little on either side; and the effect of an ounce more or less water in the bladder than before used should be observed.

There is an advantage also in using an instrument of similar form to the preceding, but with a small channel traversing the male blade and entire length of the sliding

rod. In this way, without removing the instrument from the bladder, we may add to or diminish the contents of the bladder, and thus search for the fragment under different conditions of the viscus. I succeeded recently with an exceedingly troublesome fragment which had eluded me at two somewhat prolonged sittings previously, by using this instrument in the following manner:—The patient was seventy-five years old, had a very large prostate and a greatly-diseased bladder, with phosphatic calculus, all of which had been removed except this small bit. I introduced the hollow lithotrite, the patient standing and leaning forward, opened the blades about an inch, and then allowed the urine to flow out altogether, through the hollow male blade: on closing the blades (that is, *drawing down the female blade* upon the male, not raising the male blade, an important distinction) I found and crushed the missing fragment. This case was perfectly successful; it is not in my illustrative cases at the end of the volume, this being the only circumstance requiring mention.

Finally, if we fail by this means, there still remains another, a favourite method with Civiale, in whose hands I have seen it very successful. The instrument to be employed is the “trilabe,” or “pince à trois branches,” one of the earliest which were designed in the history of Lithotripsy. The instrument (see fig. 67) consists of a

FIG. 67.

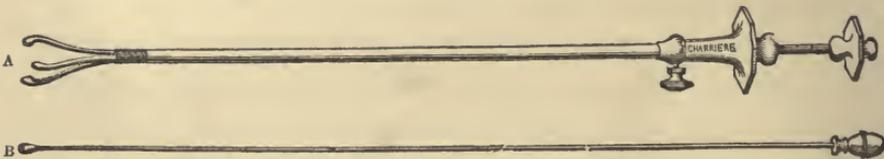


Fig. 67. A. The Trilabe, open, as in the cavity of the bladder. B. The axis which perforates the centre of the instrument, its roughened head occupying the centre of the space between the opened blades. Here it is shown separately from the rest of the instrument.

straight cylindrical sheath, containing a stem, having three branches at its vesical end, which expand on pushing them outwards, and approach each other closely on being drawn in: in the centre is a fourth branch with a rough head, which can be rotated or otherwise moved independently of the rest. To search for a final fragment, introduce this instrument into the bladder, which should contain about five or six ounces of water; expand the branches a little, and rotate them once or twice by way of searching: meantime the urine slowly runs off through the instrument until the three blades are surrounded on all sides by the walls of the bladder, a cavity of a pyramidal form existing between them. Into this cavity the fragment is almost certainly brought: it may be felt for there by the central branch. The branches are now slowly withdrawn into the stem, the cavity slowly contracts in size, and the fragment is found in its centre, and will be crushed either by them as they finally close, or by rotating the central one. It is difficult perhaps to render the action perfectly clear by verbal description, but in practice it is very efficient, and by no means a painful proceeding if properly done.

Nevertheless, while it is a rule in searching for minute fragments at the end of a case to employ a small and light instrument with a small quantity only of urine present, there are some bladders of which the interstices are so numerous from fasciculated muscular coats, that small fragments become engaged in them, and evade all search by that means. Then, a briskly-made injection of as many ounces as will distend the organ without giving pain often succeeds in dislodging the fragments and bringing them into the cavity, where, if not removed by the evacuating sound employed for the injection, they may pro-

bably be seized with the lithotrite after a portion of the water has been allowed to flow off.

The removal of fragments by the evacuating catheter may be necessary in

any case, although, as before said, in many it is not so; but in the presence of hypertrophied prostate, and still more in an aton-

nied bladder, it is essential. This catheter should generally be of silver, it is sometimes of steel, and as large as the urethra will admit, with a large oval orifice near to the end; the surgeon should be provided with one having the opening on the convex and the other on the concave aspect of the curve (figs. 68 and 69); they may also be placed laterally (fig. 70). There should be a flexible gum elastic or metal-jointed stylet, perfectly filling the interior, at all events at the lower

end where the opening is situated, that the instrument may pass smoothly into the bladder (fig. 70, A). It may be provided with a stop-cock or not (B), or the syringe may have a movable piece with stop-cock fitting both the evacuating catheters, in which case it is unnecessary. In washing out, the patient should be placed upright, or leaning forward; from four to seven or eight ounces (according to the capacity of the bladder) of warm water may be thrown briskly

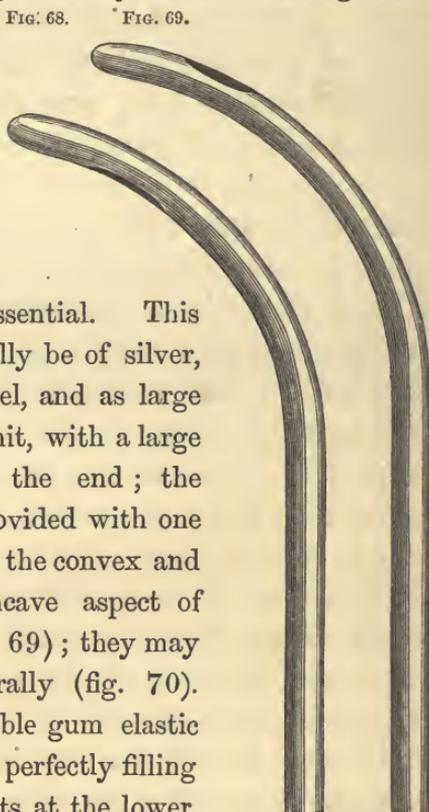


Fig. 68. Evacuating Catheter with oval opening on concave side.

Fig. 69. Ditto, on convex side.

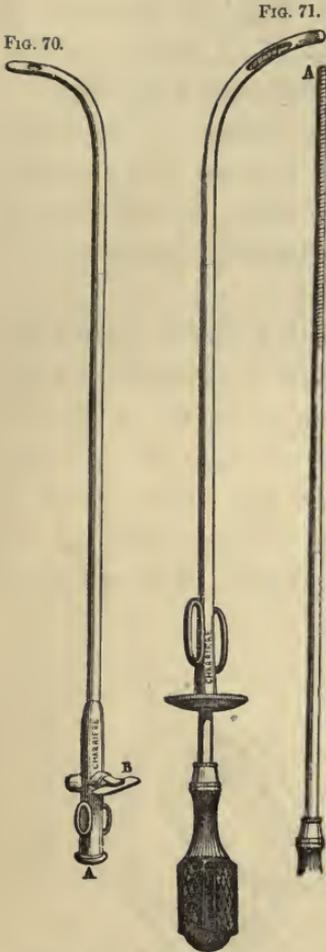


Fig. 70. Evacuating Sound, with lateral apertures. A and B, stop-cock and nozzle for injecting.

Fig. 71. Ditto, mounted on metal-jointed stylet. A, stylet removed.

into the cavity and allowed to run out instantly in full stream, the opening of the catheter being brought close to the neck of the bladder. This process may be repeated three or four times if no particular uneasiness is experienced.

Double-current catheters do not admit of so much space for the passing of fragments outwards, because a portion of the instrument is occupied by a channel for the inflowing current. But when a continuous flow is desired they are efficient instruments. When withdrawing an evacuating catheter from the bladder after washing out, the operator should always remember that a fragment may be engaged in the orifice and be protruding from it, an occurrence by no means unfrequent. If so, he can easily ascertain the fact, for in drawing it out carefully

he will perceive a light resistance when the fragment touches the neck of the bladder, and the patient will probably experience a little pain. If the resistance is very slight, it is only necessary to withdraw the catheter slowly and gently, and no harm will result; by humouring it, and giving plenty of time, not a scratch will be inflicted, and no pain

will be occasioned. If, on the contrary, the resistance is obvious, a jointed metal stylet (fig. 71 A), which fits the catheter, being pushed home, the fragment will either be crushed or disengaged, probably the former; if the latter only is desired, a current of water inwards will probably effect the object. The attempt to crush in this manner is best accomplished when the evacuating catheter is of steel.

Mr. Coxeter has recently produced a double-current catheter on an improved principle, which is illustrated by the adjacent figures. Fig 72 represents a catheter of the old construction, which throws the current upwards and forwards. Fig. 73 represents the new one, which directs it downwards, so as to stir up the detritus lying at the bottom of the bladder, and thus promote their expulsion with the outflowing stream.

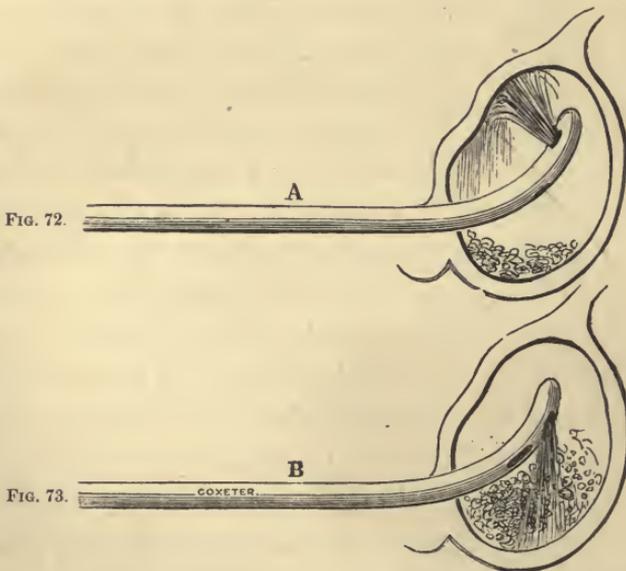


Fig. 72. Double-current Catheter, of ordinary construction, in action in the cavity of the bladder.

Fig 73. Coxeter's new instrument.

Mercier, of Paris, uses one of his favourite form, in which the orifice is well placed for the purpose (fig. 74).

Treatment following the sitting.— Much might be said in reference to this subject, if every accident possible to occur were to be considered and provided against. Those of the most importance will be considered here : some have been already slightly alluded to.

The principal aim of modern Lithotrity, as by this time will have become obvious, is to crush the stone without risk, not only of danger from the operation itself, but from the occurrence of serious difficulties afterwards : for many of these the manner of performing the operation is answerable. Formerly, a case was rarely conducted to its termination without some grave troubles from the impaction of fragments in the urethra. Now, this is a rare occurrence. Fragments are rarely impacted unless they are sharp and angular, or the walls of the urethra have been lacerated. If care is taken that the patient passes his water, at all events in the recumbent, and if possible in the supine, position, for a day or two after each of the first two or three sittings ; and if the operator is fairly successful in pulverizing the stone subsequently, not much risk of trouble will arise on this

Fig. 74.

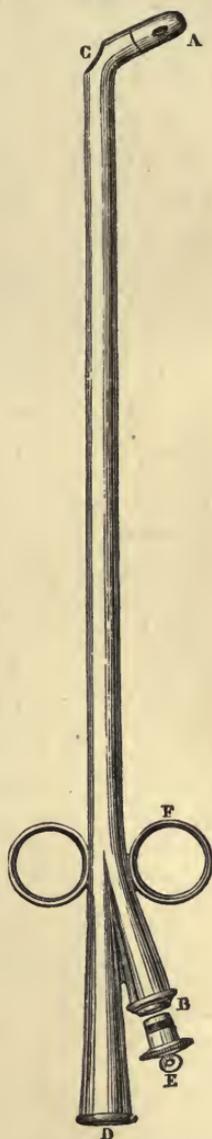


Fig. 74. Mercier's double Catheter. A, Aperture by which the water enters the bladder. B, Aperture for injecting. C, Aperture for return of water from the bladder. D, Aperture of exit.

head. After a short sojourn in the bladder the angular fragments become water-worn, their points and edges are rubbed down, and they pass without difficulty. At the same time, by means of a full-sized evacuating sound, either plain or with double current, most of the fragments that do not pass easily by the urethra may be safely evacuated.

Supposing, however, a fragment to have become arrested in the urethra, and the patient to be able nevertheless to relieve his bladder in a diminished stream, the pressure of the urine usually brings it forward in a few hours to the orifice, or near to it. If not, an attempt may be made to remove it, and with a well-made urethral forceps this may be accomplished almost at any depth. The long stems of the forceps should be slightly curved so as to cross each other; in this way an instrument may be constructed seven inches, or more, in length (not including the rings), the blades of which will open sufficiently to seize a fragment two or three eighths of an inch in diameter, without overstretching the meatus externus. A drawing of one, made for me by Messrs. Weiss and Son, is annexed (fig. 75).

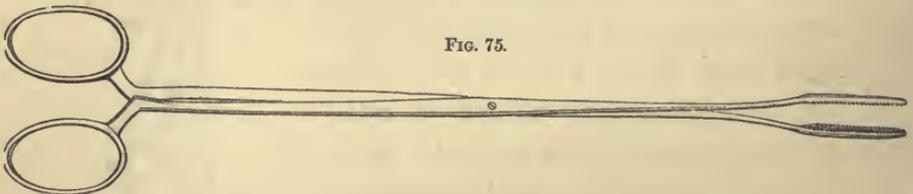


FIG. 75.

Fig. 75. The long urethral Forceps described. They are drawn of exactly half the length of the original.

They are $8\frac{1}{2}$ inches long, and will pass to the neck of the bladder in most individuals. Furthermore, the ends of the blades should not be pointed, should not meet each other,

and should be slightly scoop-shaped. With this instrument I have extracted large fragments with great ease. All that is necessary for this purpose is to commence with a fair firm hold on the fragment, and then to give plenty of time to the withdrawal, extracting as slowly and gently as possible. In this way it is remarkable how large and sharp a fragment may be safely removed, whereas by force the urethra is lacerated, and the extraction is rendered much more difficult. Sometimes it is necessary to return to the bladder a fragment situated in the prostatic or membranous portions; but all on this side the last-named spot should certainly be extracted. To effect the former object, a large wax or gum elastic bougie often suffices; if not, a large silver catheter, the end of which is cut off, and the opening accurately fitted with an olive-shaped knob attached to a stylet, is passed down until the fragment is reached; the stylet is then withdrawn, the rim of the opening at the end of the catheter surrounds the fragment, and will remove it safely into the cavity on making pressure: sometimes a stream of water forcibly injected will displace it more readily than the instrument. Some operators prefer to extract with a small three-bladed forceps (*"pince à trois branches"*) (fig. 67, p. 190). The small urethral lithotrite (fig. 76) is used by others, but the simplest instrument, and

FIG. 76.

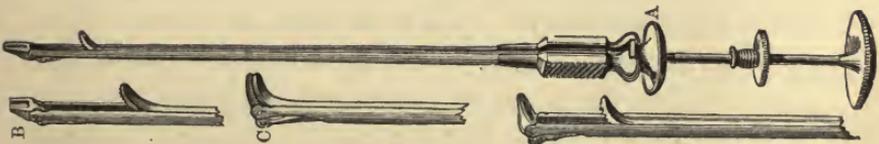


Fig. 76. A small urethral Lithotrite, the female blade of which can be depressed by turning the disc A to the left. After insinuating it beyond the fragment, it can be raised by turning the disc to the right, when, by means of the male blade, the fragment can be crushed. B, female blade depressed. C, the blades closed.

in my opinion the most efficient, since it is much more immediately under the guidance of the hand than those which are more complicated, is the long urethral forceps described above. The employment of small crushing instruments in the urethra requires great care and extreme delicacy of manipulation, or more harm than good may be done ; and should not be resorted to unless the forceps have really failed. A long cuvette, well constructed, is a very useful aid ; and is in some circumstances the most efficient means which can be employed.

Occasionally, but very rarely, it is necessary to cut down upon an impacted fragment, either in the perineum or near to the meatus externus. If it remains there, obstructing micturition, or if it is lodged in the soft parts surrounding the urethra, which is apt to happen in or about the membranous portion, causing much disturbance, or threatening abscess, it must be removed by incision. I have never had occasion to do this after Lithotrity. The external meatus is sometimes small, and requires to be divided ; a simple matter, which is best done at the outset if preternaturally narrow and interfering with the easy transit of proper instruments.

With the proceedings for crushing stone, the removal of foreign bodies introduced into the bladder is closely allied. Few of these can be crushed : almost all must be removed either entire, or after division into one or two pieces when necessary. It is more common to meet with them in the female than in the male bladder, always excepting for the latter sex, fragments of bougies and catheters which, especially when made of that treacherous material the gutta-percha of commerce, are liable to break, and thus to occasion this accident. Pieces of stick, straw, and

sealing-wax are occasionally introduced; an example of the last-named kind, which occurred in my own practice, is given in Case No. 10, page 256. It is worthy of note here that sealing-wax is not friable at the temperature of the body, and cannot be crushed. For the removal of some of these foreign matters, the French makers have designed several ingenious instruments. Figs. 77 and 78 represent those which are adapted for laying hold of a portion of bougie, flexible and inflexible, respectively, and bringing it away safely. The instrument (fig. 77) is introduced into the bladder with its extremity in the condition shown at *a*, a hook is then made to issue from it and search for the flexible bougie by moving the handle *B*: the bougie being seized, it is forced into a position which coincides with that of the long axis of the instrument, as seen at *b*, which insures its safe withdrawal. Fig. 78 is another instrument which similarly deals with a portion of metallic catheter or bougie. Figs. 79 and 80 represent instruments ingeniously contrived for a similar purpose in relation to the female bladder, particularly for the removal of hair pins, or other pieces of wire, so that it is scarcely foreign to the purpose to mention them, especially as it is by no means impossible that they might be useful for the other sex. Fig. 79 acts by seizing, folding, and drawing a wire into a straight tube. Fig. 80 removes them without folding, but by simply seizing and adjusting them to the long axis of the instrument.

It is not my intention to dwell at length on complications frequently arising in connection with Lithotrity, which require treatment on those general principles which it must be assumed are well understood by any one likely to practise the operation. Some remarks only will be made on those affections which directly result from operations

FIG. 77.

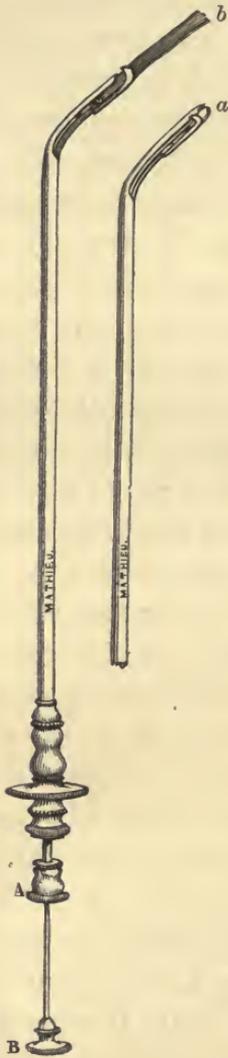
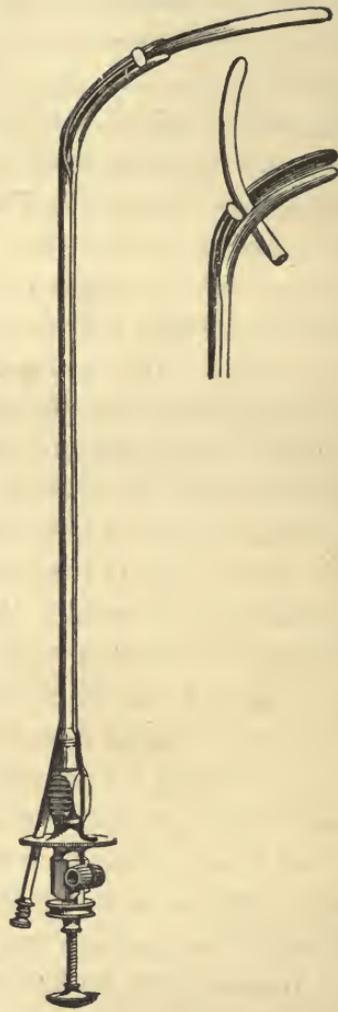


FIG. 78.



performed on the calculous subject. They may be enumerated as follows :—Fever, inflammation of the bladder or of the prostate, orchitis, hæmorrhage, and retention of urine. With regard to the influence which certain complications, affecting the patient prior to operation, should have

FIG. 79.

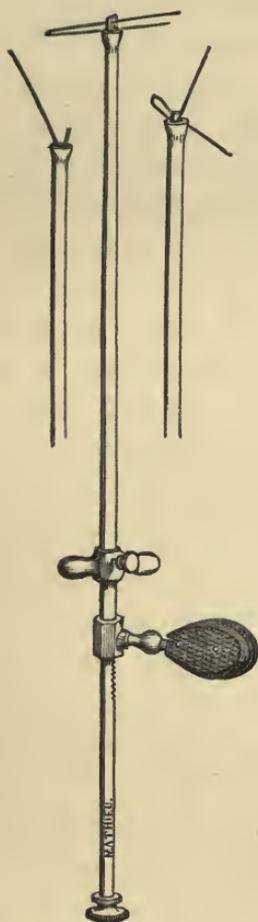
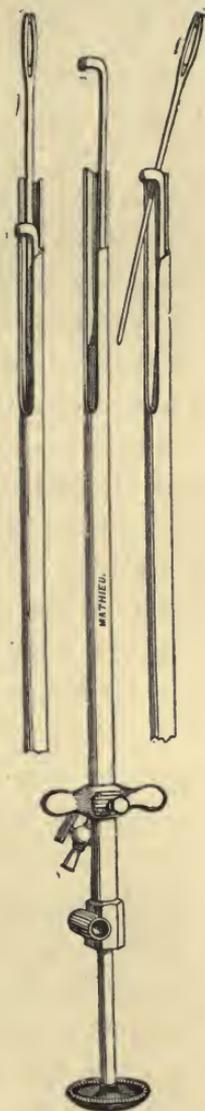


FIG. 80.



in determining what method of relieving him is to be adopted, such as extreme age, debility, renal disease, diseased bladder, enlarged prostate, stricture of the urethra,

peculiarities in the stone itself, that will be discussed in Chapter XI., which is devoted to a consideration of the numerous circumstances which should guide the judgment in relation to each individual case which comes before us.

Fever. It is by no means uncommon, although it is exceptional, that a sitting is followed by a rigor, rapidly succeeded by hot and dry skin, and subsequently by sweating. This may be termed an attack of fever. It occurs in every degree of intensity; it may commence in the faintest chill, or in a rigor of great severity, the associated phenomena generally corresponding to the initial one. In nine cases out of ten it is not of serious import; it renders the patient temporarily weak, and prolongs the treatment by rendering some postponement of the next sitting desirable. Having occurred once, it should be anticipated at the next crushing by keeping the patient warm at the time, wrapping him up well, applying hot bottles to his feet, with a glass of hot negus, brandy-and-water, or champagne, immediately after the sitting has been finished; and this ought to be short, conducted on the principle of doing little and often, rather than the contrary.

When the attack is very severe, it may announce some local affection, the onset of cystitis, or some renal implication, or inflammation of the testicle, although it may still be only severe constitutional disturbance resulting from the operation, and not producing any local inflammation; in this case the fever is more likely to continue or become intermitting. If pain above the pubes, or at the neck of the bladder, and frequent desires to make water are experienced; or, on the other hand, should severe pains in the loins and sickness occur,—counter-irritation to the supra-

pubic region, or to the loins, respectively, is of great service. I know of no better form for these cases than the repeated application of hot linseed poultices, sprinkled with mustard. Hot hip-baths, demulcent drinks, diaphoretic regimen, and mild nutriment, form the main elements of treatment; opium, if necessary, to relieve pain. The decoction of *Triticum repens*, from a pint to a pint and a half daily, is particularly useful. When the cystitis becomes more chronic, and much pus and mucus are mixed with the urine, the bladder should be washed out daily, and another crushing performed as soon as possible, since pulverizing some of the larger fragments may ameliorate the condition of the bladder sooner than any other treatment. In orchitis, which rarely occurs, fomentation and rest are necessary, but no lowering measures are to be adopted. Of course, the next sitting must be postponed until it is better, and be a short one, and more than usual care be taken in manipulating. Hæmorrhage rarely occurs; a little bleeding sometimes follows the application of instruments, and may even continue for a day or two—but this is exceptional. I have seen severe hæmorrhage occur, from the bladder, not from the urethra, probably from peculiarity of constitution, after a short sitting conducted with great care; the bleeding continued in spite of all treatment until the patient's death, which occurred in the course of a week. At the autopsy no sign of injury was discovered by the most rigorous examination, either in the tissues of the bladder or in the prostate; but the whole mucous membrane was greatly congested. The patient had been in the habit, while the subject of stone, of losing blood freely from the bladder after exercise even of a very moderate kind. The usual treatment of vesical hæmor-

rhage should be adopted in these cases,* and further attempts to deal with the stone postponed until the symptoms have ceased, when the course to be pursued is a question for very grave consideration. In a case, recently under my care, the disposition to bleed manifested itself after the first sitting or two, but it gradually got less as the end of the treatment approached, and the bladder appeared to regain a healthier tone. It was sufficient, however, at the outset to occasion anxiety, but the case terminated admirably well.

There is one condition which must always be closely looked for after Lithotriety, especially in elderly subjects. It is the occurrence of retention of urine after a sitting. It may occur very insidiously, occasioning great discomfort and even constitutional symptoms, before either the patient or the surgeon is aware of the cause. The bladder appears to be temporarily paralyzed, it becomes full and the surplus runs over, and as the urine appears in the ordinary quantity of health, the distension of the bladder is easily overlooked. It is not due to impaction of fragments in the neck of the bladder, but apparently in part to defective innervation of the organ, resulting from the operation; and in part to swelling of the urethra, or of the prostate beneath it; mostly, but not always, the natural power is speedily regained, but, until it is so, the catheter must be introduced twice a-day, or more frequently if necessary, as in all cases where this condition exists from other causes. (See Case 6, p. 250.)

As to the time during which the recumbent position should be retained after each sitting, and to the amount of confinement within doors subsequently, it is impossible to lay

* Diseases of the Prostate. By the Author. Lond., 1861, p. 204, et seq.

down any rules which can be applicable to all cases. In each it must depend on the liability to local and constitutional irritability which each case exhibits. While in some cases, where the stone is small and the patient has good health and little local excitability, I have found it scarcely necessary to enjoin confinement to the house at all (see Cases 1, 2, 4, and 7, pp. 247-52); in others it has been necessary for a period of some weeks. Generally air and some exercise can be taken between each sitting, with advantage to the patient.

There is a point of some importance indirectly connected with the operation of Lithotrity on which difference of opinion exists.

I refer to the use of chloroform during the sitting; and shall very briefly consider how the condition of anæsthesia affects the operation, because it is quite evident from the manner in which the preference to perform Lithotrity without chloroform has been viewed by some, that the grounds for that preference have been misapprehended.

First, then, let it be premised that there is no reason why the patient should not escape any degree of pain and uneasiness which attend the crushing of a stone if he be very nervous or susceptible. In these circumstances, it is no doubt better on the whole that he should be spared the excitement and the shock, which might be considerable in his temperament.

But the pain arising from Lithotrity properly performed, in a tolerably healthy and well-prepared patient, is really not much. It is uneasiness rather than pain; and as a sitting is rarely longer than three or four minutes, the demand on a patient's fortitude is not very considerable.

Now the only advantage in not employing chloroform

with which I am acquainted may be thus explained. There are certain circumstances, over which we have no control, and of which we have little knowledge, that render calculus subjects much more sensitive on some days than others. Ordinarily the patient may bear the sitting without a murmur, and after it is over, states that he has had little to complain of. But on commencing to perform it on another day, although the operator proceeds with the same care and facility as usual, the patient complains bitterly as soon as the lithotrite has entered the bladder: its slightest movements aggravate the pain, and any attempt to proceed evidently causes him much suffering. In such circumstances nature's plain indication should be followed, the instrument should be withdrawn at once, and the sitting postponed to another day. If it be persisted with, in spite of this warning, a rigor may follow, and some cystitis will, probably, be set up. It is needless to say that had chloroform been taken in such a case, nature's voice must have remained silent, and the crushing would have taken place, with questionable benefit, probably with risk. We do not know how, or why, this undue excitability was set up; no other signs might be present, cautioning the operator to hold his hand that day; but the sign of hyper-sensibility is sufficient, and it is well if the operator has the opportunity of being timely warned by it.

The condition thus described is, it may be admitted, not frequently so marked as in the instance cited, but it is very often present in a less degree. Bearing this in mind, it is always wise to shorten any sitting, or at once desist, if manipulation becomes more than usually painful. Suffering is always a sign, in these cases, of some evil, which it is desirable to avoid; it suggests increased care, if

possible, or a shorter term, and it is well to act in accordance with it.

This is the benefit, and all the benefit, which I believe attaches to the absence of anæsthesia. Each case, in relation to this matter, must be judged by its own peculiar requirements. My own practice is, to use it without hesitation when it appears to me to be necessary, or when it is much desired by the patient, and this happens, perhaps, in one case out of five. As before said, Lithotrity, in the majority of instances, ought not to occasion much suffering; and if the surgeon habituates himself to operate without it, watching for any sign of uneasiness on the part of his patient, he acquires almost unconsciously a mode of manipulating which is delicate, careful, and extremely unlikely to fatigue or irritate the bladder.

It will now be clear how completely the advantages of consciousness during Lithotrity have been overlooked by those who have regarded them as consisting in the operator's ability to ascertain by his patient's expression of suffering, when the coats of the bladder are seized instead of the stone! Slender, indeed, must be the chance of that patient's recovery, whose consciousness is needed to impart such information to his surgeon.

LITHOTRITY IN CHILDREN.—Lithotrity can be applied to patients of any age; but there are some difficulties in its employment in the cases of children which those of adults do not generally present. Regarding Lithotrity in the abstract, without reference to age, let us call to mind what are the conditions most favourable to success.

First. A fairly capacious urethra.

Secondly. A bladder displaying moderate tonicity, but not irritable.

Now, neither of these two conditions exists in children, and their absence is the source of most of the difficulties in question. 1. The urethra of the child, say from three to seven, or eight, years, is exceedingly small, and it is during this period of life that half the cases below puberty occur.

To attack a stone at this age it is, therefore, necessary to employ a very small lithotrite. Hence, none but small stones are amenable to its action, unless the sittings are numerous. Because, in a small lithotrite, the blades must necessarily be short, otherwise they are liable to break; and short blades are incompetent to grasp any but small masses. If used to break down piecemeal a stone of an inch diameter, the time consumed is considerable. Hence, in Paris, where only Lithotrity has been largely employed for children, ten, twelve, or more, sittings are common, and each sitting requires at least double the time which is necessary for an adult, from circumstances next to be alluded to. A case is on record there of a child nine years old, who, in the most able hands, was the subject of no less than seventy sittings.

2. The pyriform shape of the bladder, and its situation in the abdomen rather than in the pelvis, are unfavourable. There is no fixed area for operating as in the adult; no spot where the stone may almost certainly be found; no depression behind the prostate; and the viscus is often much distended and capacious; hence, there is extra expenditure of time in seeking the stone.

The form and situation of the bladder also favour the determination of fragments to the neck, when the patient is recumbent in the ordinary position. The organ is extremely excitable, contracting vigorously and conti-

uously with very slight irritation. Hence, it is difficult to retain fluid for the purpose of operating; and impaction of fragments in the urethra readily takes place after the stone has been crushed. It is common to encounter much difficulty from this cause; obstinate retention of urine not unfrequently resulting, which has sometimes to be relieved by cutting down on the fragment, and removing it through the perineum.

Furthermore, these young patients possess none of that self-command which so often conduces to the success of the proceeding in the adult; and chloroform must always be employed in their cases.

Incontinence of urine after Lithotrity in children is not a very uncommon result, happening much more frequently than in the adult; but it generally disappears spontaneously in course of time.

If it is decided to operate in any given case, the urethra should be dilated on three or four occasions previously, the pelvis should be well elevated; the improved screw lithotrite, with plain blades, is, perhaps, the best; and if the stone, when caught, proves to be no larger than a pea, it should be efficiently crushed at a single sitting, care being taken to pulverize it thoroughly. Providing it is thus small, the proceeding is generally successful. The child should be confined strictly to bed, have plenty of demulcent drink, an opiate if much straining follows, and warm baths. In the case of my own, given as an illustration in Chapter XII., No. 17, the stone was quite small, and crushed therefore at a single sitting. Such a result must be regarded as a simpler and safer proceeding, probably, than Lithotomy. But where more than two or three sittings are necessary, the advantage of Lithotrity

FIG. 81.

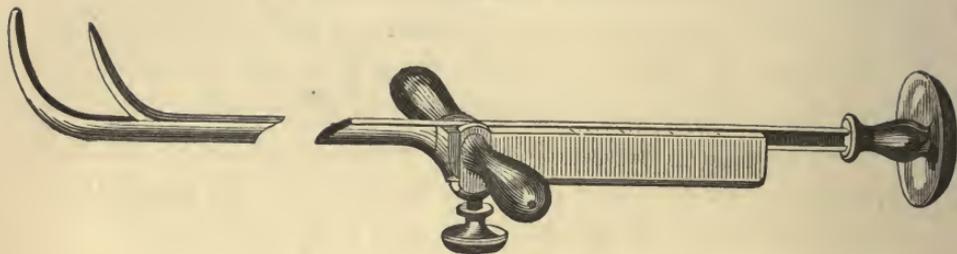


FIG. 82.

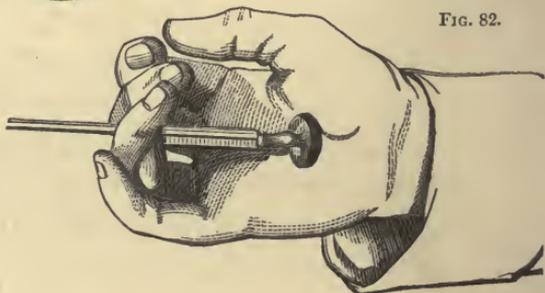


Fig. 81. A small Lithotrite without screw, for young children. Its size is about No. 5.
 Fig. 82. The transverse bar is the base of support against which pressure by the hand crushes the stone.

appears to be very doubtful. The instrument I used in that, and other cases, is one without a screw; the crushing power being obtained by simple pressure in the palm of the hand; and this is ample for the small concretions to which it is applicable. Fig. 81 represents the instrument, and fig. 82 the mode of applying it.

Boys, from nine to thirteen, are somewhat more promising subjects, but in them the same sources of difficulty exist, though in a less marked degree.

Dr. Guersant of Paris, surgeon to the Children's Hospital, reported twenty-one cases of children, on whom he practised Lithotrity, in which there were six deaths; "two," he states, "from the operation, and four from inter-current diseases." Besides these, three others were subsequently cut. Lithotomy in children, following unsuccessful Lithotrity,

does not appear to be a promising operation : every one of the three died. It need hardly be added that English Lithotomy affords results incomparably better than these. The deaths to recoveries between the first and the fifth year are only one to thirteen, and between the sixth and the eleventh year, only one to twenty-two and a half. (See Table at end of Chapter XII.)

I shall close this chapter by recapitulating briefly a few of those practical maxims, which have been regarded in this and the preceding chapters, as among the most important to guide the practitioner of Lithotriety.

1. Let the urethra at the outset be accustomed to contact with instruments, so that the lithotrite, which it is necessary to employ, can be passed without causing much uneasiness, or any bleeding (p. 140).

2. Always operate, whenever this is possible, without previously disturbing the bladder by injecting or sounding (pp. 164-6).

3. Having determined the position of the patient according to the necessities of the case, slowly introduce the lithotrite, and take care that the blades reach or pass beyond the centre of the bladder before the male blade is withdrawn.

4. Execute every movement deliberately ; open and close, incline, or rotate, slowly, without any jerk whatever ; and all without bringing the blades into contact, as far as it is possible, with the walls of the bladder.

5. Maintain the long axis of the instrument in the median line of the body and the blades at or near the

centre of the bladder, this being the area for operating mostly to be chosen. In screwing home the male blade to crush, it is especially necessary to keep the instrument steady, otherwise much vibration of it may be occasioned, and much lateral movement of the blades from its axis at each turn ; a small deviation at the handle produces a large one at the blades.

6. The usual position of a large stone is near the neck of the bladder ; of a small one at or near the back of the trigone, and the lithotrite should be applied accordingly (p. 178).

7. When the stone is caught, especially if in the fenestrated lithotrite, rotate it a fourth of a turn on its axis before screwing up firmly or crushing, to make certain that nothing is included besides the stone.

8. Having broken a stone or a large fragment, the operator may pick up and crush piece after piece consecutively, without further searching, if he is only careful to work the lithotrite exactly at the same spot—the patient of course not shifting his position—since fragments fall immediately beneath the blades of the instrument, and rest there (p. 181).

9. Never withdraw a lithotrite *loaded* with calculous débris ; a moderate quantity will come away between the plain blades ; but if an impediment is felt at the neck of the bladder on withdrawing, return to the centre of the cavity and unload them. This can always be done with a properly-constructed lithotrite (p. 185).

10. No sitting should exceed five minutes in duration, except under very peculiar circumstances. The large majority of sittings should occupy only three minutes, some less. The mere sojourn of a lithotrite, without any move-

ment, for three minutes in the bladder, causes uneasiness, and often subsequent irritability, which may be considerable if the time is prolonged.

11. If the patient experiences an unusual amount of pain at the commencement of any sitting, it is wise to postpone it until another day, or make it very short. Such unlooked-for pain is a useful intimation that the urinary passages are not at this time in fit condition for our purpose, and by acting upon it, we may avoid serious mischief (p. 206).

12. After the first sitting it is generally desirable that the patient should have hot fomentations to the hypogastrium and perineum, remain in the horizontal position, and pass his water in that position if he can. He should remain tolerably quiet until the débris has passed, which usually happens within three days of the sitting.

13. The removal of débris by injecting and washing out the bladder is to be considered the exception to, and not the rule of, practice.

CHAPTER XI.

ON THE CHOICE OF PROCEEDINGS BEST ADAPTED TO DIFFERENT CASES.

Importance of accurate Diagnosis.—Without it Choice of Operation impossible.—Sounding.—Classification of Stones.—Questions to be determined respecting the Stone.—1. The Age of the Patient—Results of Investigation; Ratios of Death at Different Ages in 1827 Cases of the Lateral Operation, Metropolitan and Provincial; how affected by Age; Prevalence at Different Ages.—2. Absence or Presence of Local Disease, their bearing on the question of Operation.—3. Susceptibility to Constitutional Disturbance.—Final Deductions as to Choice of Operation for Different Patients.—When not to Operate.—Immense Importance of Detecting the Stone at an early Period.

IN approaching that final appreciation of the various methods which have been described, we cannot but be struck with the single broad feature which marks our subject at the present day, and distinguishes it from the subject as it has been dealt with in times which are past.

An appreciation of methods was impossible when only one method existed; or at most, but one other for very exceptional cases. Given, the simple fact of stone in the bladder, it was, but a very few years ago, removed, as a matter of course, by incision after the lateral method; only here and there, the high operation was resorted to. Nevertheless, the body to be removed might be so small

as to be almost inappreciable ; it was sometimes carried out by the first gush of urine when the bladder was opened, and was never discovered. It might be smaller in size than an apple-pip, or as large as a turkey's egg, still one and the same set of incisions was practised ; lengthened, perhaps, in some cases, if the existence of a very large stone was suspected. But as new methods of operating were designed, and especially when the possibility of removing a calculus by crushing had been demonstrated, a new ground of inquiry became necessary to success, one which had been almost overlooked because barely required before. It followed instantly from the new phase into which practice had entered, that a *diagnosis of the size, form, and chemical characters of the stone was absolutely necessary*. With various modes of Lithotomy to select from, adapted to various conditions of the patient and of the stone itself ; with Lithotrity and its varied resources besides, it becomes at once a matter of the highest importance, if any advantage is to accrue from the discovery of these methods, that the case and the method should be judiciously adapted to each other. Otherwise it might happen, and I do not hesitate to say that it did happen, in the earlier experiences of Lithotrity, especially when it was first attempted by others than the originators of the art, that the new method, although a great advance in surgery, at this time actually increased the fatality from stone operations, and was a positive calamity for many stone patients at that era. I have abundant evidence before me of the increased mortality which was occasioned by it during the period in which its application was mainly experimental. This apparent paradox is easily explained ; the cause was, partly, that experience was at first necessarily

wanting, by which to form rules for the operator's guidance, and partly, that the importance of diagnosing the characters of the stone had not been perceived. Hence patients who were well adapted for Lithotomy, and who would have been saved by it had Lithotripsy not come into vogue, were submitted to the crushing operation, which was unfitted to their cases and terminated them fatally. Hence, also, much undeserved obloquy fell on Lithotripsy. These sad illustrations of the want of adaptation of the method to the case were then numerous, and this depending very greatly on the absence of a correct diagnosis as to the nature of the body to be removed from the bladder, and of the varied capabilities and adaptation of each of the principal means for effecting its removal. And I will venture to say with deliberate conviction, that the importance of such a diagnosis is not sufficiently perceived at the present day, and consequently only a portion of the advantages placed within our reach by modern methods have yet been attained. The increased resources of surgery render this a most important branch of inquiry; one, indeed, to which it is absolutely necessary for the practical surgeon to devote himself. Otherwise these resources will become the occasion of misfortune rather than of benefit, and will diminish rather than augment the success of his practice.

It must therefore appear that an appreciation of the absolute and comparative values of the varied operations which are offered for our selection is not possible unless it first be granted that we are able to diagnose the physical and chemical characters of the stone, before any attempt is made to remove it from the bladder. Unless, then, this can be done—unless, indeed, it is done with tolerable accuracy, it will be better to return to the use of a single

method, say the lateral operation, than to risk the application by guess of a method inapplicable to the case. Thus to take an extreme, but quite possible, case for illustration, let us suppose two adults, one of whom has a small, friable stone, the other a large compact one ; that, being deceived as to the relative proportions of the stone from want of care in diagnosis, I decide to cut the patient with small stone and to crush the large stone ; I run a certain risk of losing both, and do so ; whereas, had the terms of my decision been reversed, the chances are that both were saved. But had the lateral operation been employed in both, the chances are equally great that I should at all events have saved one.

I repeat it, then, it is probably safer, uniformly to practise Lithotomy in every instance, if the surgeon does not arrive at an accurate diagnosis of the nature of the stone, and select an operation in accordance with it.

There are two principal facts which it is necessary to ascertain respecting any stone which it is proposed to remove from the bladder ; its size and its texture. In a degree subordinate to the latter character, it is desirable to know its chemical characters. It is highly important, also, to ascertain the patient's susceptibility in relation to instrumental interference, a matter which has already been alluded to.

In sounding a patient for the purposes of diagnosis, we should place him usually in the first position for Lithotrixy, as already described (p. 160) ; if we do not succeed in that position, or if his prostate is enlarged, he should be placed in the second position (pp. 161-2). Furthermore, it is absolutely necessary that the sound should have a form altogether different from that of a common catheter. Its curved

part, or beak, should be little more than an inch long, and have more of a tendency to form an angle with the shaft than exists in the catheter. It can then be easily inclined to right or left, or rotated completely if need be. Various forms are employed for the purpose ; that shown at Fig. 83, and represented in the reversed position within

FIG. 83.



Fig. 83. Sound, with small curve, for exploring the bladder. An opening is seen in the convexity of the curve for increasing or diminishing the fluid in the cavity. The beak is solid.

the bladder, is a very excellent model, and, being less angular than some, passes with greater ease. But then it is hollow also, enabling the operator to inject more water into the bladder, or to withdraw some during the process (a valuable resort in cases of obscurity), without change of instruments for the purpose. Thirdly, we may use a sound which enables us to measure the stone with precision (fig. 84). It may have a blade which opens so as to seize it, and an index in the handle, like that in a lithotrite, which indicates the diameter when seized. At the same time, such an instrument is better balanced than a lithotrite, having a lighter handle, so that we can explore the bladder with greater facility and lightness of hand, than with the crushing instrument, which is a little

FIG. 84.



FIG. 85.



Fig. 84. The hollow Sound, with blades to measure the stone, closed.

Fig. 85. The same, open.

unwieldy from its weight. This sound is made of steel, and its beak is solid, so as to produce a clear and ringing sound when a hard calculus is struck.

The act of sounding should be performed precisely in the manner in which the search for the stone, and for fragments by the lithotrite is conducted, and which has been already fully described. A large stone, it may be recollected, is generally encountered immediately on entering the bladder, near to its neck. A small one is commonly situated at the back of the trigone, and all generally lie either right or left of the median line. If not at once encountered, it is necessary to explore consecutively and carefully the upper and lower parts, and the sides of the bladder; also with large and small quantities of fluid in it: and finally in the upright, as well as in the horizontal position, although this latter position is very rarely necessary. When, notwithstanding all, the stone still remains undetected, as when it lies behind an enlarged prostate, for example, and in some other circumstances, much may be gained by placing the forefinger in the rectum, where the stone may often be felt very distinctly, or lifted up so as to place it between

the finger and the sound, or between the jaws of the lithotrite.

The stone being found, the characters are next to be determined. These may be classified as follows for facility of reference.

I. *Size*.—With regard to size, stones may be classified as *Small*,

Medium, and

Large.

II. *Texture*.—With regard to textures, stones may be classified as *Soft*, and

Hard.

And hard stones may be either $\left\{ \begin{array}{l} \textit{Friable}, \text{ or} \\ \textit{Compact}. \end{array} \right.$

Every possible variety in size necessarily exists between the two extremes of small and large, and some latitude in the use of these terms, as well as in that of medium must be afforded. Hence, they convey only an approximate estimate in any case : a stone, however, measuring an inch in diameter, that is, the mean of two diameters, the longest and the shortest, may be regarded as a type of the medium size.

With regard to texture, the variations are more marked : each chemical constitution indicating distinctly certain physical characters.

Soft Stones are phosphatic, with chiefly earthy bases. The urine is alkaline, and is charged with earthy phosphates. Pus and mucus are also commonly present.

Hard Stones are oxalate of lime, uric acid, urate of soda, and mixed, *i. e.* alternating layers of uric acid, or urate with phosphatic deposit. The urine is mostly acid, contains crystals of uric acid ; the amorphous deposit of

urate of soda, or the octohedra of oxalate of lime, and if any of these are found as a persistent deposit in any given case, it goes far to establish the nature of the calculus.

But while all of these are "hard," some are friable, while others are not so, but exceedingly compact in their structure. This is a distinction of great practical import in Lithotrity. Hard, but friable, stones break without the exercise of great power; and they crumble into small granular masses, instead of fracturing into sharp angular portions as stones of compact structure are prone to do.

Each kind of calculus has its own mode of breaking. Thus oxalate of lime, which is very compact, requires great power to fracture it, and it mostly forms irregular jagged masses.

A uric calculus, when nearly pure, has an exceedingly compact texture; it requires considerable power, and fractures into wedge-like splinters, which are very hard and sharp.

Urate of soda is looser in texture, friable, and granulates easily under smaller degrees of power than are required for either of the preceding calculi. The mixed calculus also breaks easily, because its several layers have unequal powers of resistance: the phosphatic constituent granulates, and the thin alternating layers of uric acid, or the urates, fracture into flat and shell-like pieces. These general indications are practically sufficient without descending to minor distinctions or rare varieties of calculus.

We can and ought, then, in every case, before selecting the operation for its removal, to determine—

1. Whether a calculus is large, medium, or small, which can be done by measuring it, either with the exploring sound described, or with a common lithotrite. Attention to the previous duration of symptoms will, of itself, afford some clue to the size, and, especially, if we are acquainted, from observation of the urine, with the chemical character of the stone. A pure uric acid calculus is slowly formed : so is oxalate of lime. Urate of soda concretes in a shorter space of time, the mixed form more quickly still ; and the phosphatic are produced with greater rapidity than any.

2. Whether the calculus be hard or soft is determined by the click, or ring, obtained on striking it with the instrument in the bladder : clear and sonorous in the case of hard stones, and dull in that of soft ones.

3. Whether it is friable or compact in texture may be generally determined by ascertaining what is the persistent deposit in the urine during some days or weeks, if not previously known ; from which one may almost certainly judge of the chemical nature, and hence of the physical structure, of the existing calculus, remembering, however, that phosphates are frequently present from irritation produced by acid calculi.

4. It is necessary to ascertain whether there is one calculus only, or more than one, in the bladder, a matter of no little moment. It is exceedingly difficult, if not impossible, to determine this accurately with the simple sound, the signs afforded to it by multiple calculi being very deceptive. With the measuring sound described above, it is easily determined. One calculus being seized, it is held between the blades, and the search is continued for a few moments with the stone in that position. If another is present, it is almost instantly struck either by

the instrument, or by the stone already secured within its grasp.

Having thus determined these particulars respecting the stone or stones, we are in possession of the first series of data which enable us to decide on the operation to be recommended.

The remaining series of data necessary, consists in the condition of the patient, local and general, and may be obtained under the following heads :—

1. Age.
2. Absence or presence of local disease.
3. His susceptibility to constitutional disturbance as a result of local irritation.

1. The age of the patient :—

This is a very important element in dealing with this subject. So much so that the early age of the patient, a few cases only excepted, may be held generally to decide the nature of the operation at once. By an early age I mean infancy and boyhood ; or, to speak more exactly, from birth up to ten or eleven years. But in ascending the scale above this period, age becomes less decisive in its indications. In order, however, to obtain a solution as far as possible of this very serious question, I have collected a large table of perfectly-authenticated cases of Lateral Lithotomy, approaching two thousand in number, and comprising the entire results of extended practice by known operators in certain districts of this country.

I have not collected from all available sources. On the contrary I have rejected many opportunities of largely augmenting my total, as unsuitable for the purpose in view. Thus, some operators selected their best cases for Lithotrity, others for the median operation ; on this account I have

not included here Mr. Teale's valuable and well-known experience. Others again, and this will apply also to the gentleman just named, were men of so great celebrity in their districts, that the worst and oldest examples of the complaint were attracted from afar, and contributed to make such an experience by no means a fair and average product of the neighbourhood. I have therefore been compelled to exclude Mr. Crichton's long and valuable list in my possession, because it contained a most unusual proportion of aged patients. But the most considerable sacrifice of this kind which I have made is the exclusion of Dr. Keith's large and admirable experience. He has, in the most generous manner, placed at my disposal extremely complete notes of all his cases, above 300 in number, a very large proportion of which are those of aged patients who have sought his aid from a distance. During the last 25 years he has cut 182 patients, the average age of whom is 56 years and 7 months; among them are only 15 patients below 18 years of age.* The average weight of stones, 7 drachms; the average measurements, 2 inches in length, one in thickness, and $1\frac{1}{2}$ in breadth: 144 have been cured, 38 died, equalling an average of one in $4\frac{3}{4}$ cases. Besides these he has performed Lithotrity in 122 cases, with eight deaths; the average age being equal to that in the previous class: they were the healthiest subjects, with much smaller stones, only three were below 18 years of age. It is superfluous to point out the excellence of these results.

The experience of the Glasgow Infirmary, numbering 152 cases, is not employed in this department of the inquiry, because a large proportion had been operated on by

* Ordinarily, half the total number of cases of calculus in a district is found in patients below 13 years of age.

the method of Dr. Buchanan. So, also, that of the Bristol Royal Infirmary, kindly afforded me by Mr. Pritchard, simply because it was not possible to ascertain correctly the ages of all the patients submitted to operation. The same remark applies to some of the metropolitan hospitals, to which access has been kindly afforded.

Such care is essentially necessary in order to obtain valid numerical results. My table, then, is composed as follows :—

The experience of the Norfolk and Norwich Hospital, including the 669 cases published by Mr. Crosse, in his well-known and valuable work, and 124 more cases immediately following these, during a subsequent period, and not interfered with by other modes of practice. For these I am indebted to my friend, Mr. Cadge, of Norwich.

The records of the Radcliffe Infirmary, Oxford, up to the present time, for which I am indebted to Mr. E. L. Hussey, of Oxford. The entire experience of University College Hospital, London, from an early date until very recently, for which my best thanks are due to each and all of my esteemed colleagues.

A detailed account of all the cases met with at the Leicester Infirmary, obtained for me by my friend Mr. Thomas Paget. The experience of the Leeds Infirmary, for which I am indebted to my friend, Mr. Thomas Nunneley. That of the Birmingham General Hospital for the last ten years, kindly placed at my disposal by Mr. O. Pemberton. The records of Guy's Hospital, carefully prepared by Mr. Thomas Bryant, who most readily permitted me to make any use whatever of them. The experience of the surgeons of St. Thomas' Hospital, for which my thanks are due to

Mr. Solly, Mr. Le Gros Clark, and for valuable aid in my inquiries to my friend Dr. Bristowe.*

I am also a debtor for much kindness and pains to Dr. George Murray Humphry, of Cambridge, in affording me the experience at Addenbrooke's Hospital; an additional number of 183, including 13 deaths, a result which is so much better than any other, viz. one in 13 cases, that I am compelled to mention and register it separately as well as collectively. Once for all, let me say that, respecting every one of these cases, I have received, and now possess, exact particulars in writing from the most competent person to furnish it: those cases only excepted which have been referred to as already published by Crosse and South.

The sum total, with Cambridge, is 1827 cases of Lateral Lithotomy, including 229 deaths, or one in 7·977, almost exactly one in 8. Without Cambridge it is 1644 cases, with 216 deaths, or one in 7·62, in round numbers $7\frac{1}{2}$.

The separate results are as follows:—

Norwich (Crosse)	669	cases, with 91	deaths, about 1 in	$7\frac{1}{2}$	cases.
Since that time	124	„	15	„	1 in $8\frac{1}{4}$ „
Oxford	110	„	14	„	1 in 8 „
Leicester	90	„	8	„	1 in 11 „
Leeds	29	„	4	„	1 in $7\frac{1}{4}$ „
Birmingham	102	„	10	„	1 in 10 „
Guy's Hospital	230	„	33	„	1 in 7 „
St. Thomas's do.	200	„	29	„	1 in 7 „
University Coll. do.	90	„	12	„	1 in $7\frac{1}{2}$ „
	<hr/>		<hr/>		
	1644		216		
Cambridge	183	„	13	„	1 in 14 „
	<hr/>		<hr/>		
	1827		229		

It must be remembered that these ratios of death alone furnish no certain index of the success which has followed

* A portion of the St. Thomas's cases are the more recent ones (those in which all particulars were present), belonging to the well-known Table published by Mr. South, in his edition of Chelius' Surgery, vol. ii. p. 635.

the operation at different institutions. It is necessary to know also the relative proportions of young and aged patients included in the number, since the rate of mortality differs so greatly at the different extremes of life. Taking the whole number of 1827 cases, half of them occurred in patients under the age of thirteen years. Applying this rule to any of the separate reports, we have an easy and tolerably accurate mode of testing the relative proportions in question. In metropolitan hospitals, to which many patients from the country are sent up, these being almost always adults, the proportion of aged patients is larger than that in the provincial hospitals. Thus in the records of University College Hospital, instead of half the number of patients being below thirteen years, those below that age form only two-fifths of the total, from the unusually large proportion of elderly cases. In the Norwich Hospital the proportion of adults is also larger than the average, while that of Cambridge has a little more than the common proportion of children. The metropolitan hospital of Guy's has, however, also an unusually large proportion of young cases.

But for our present inquiry it is necessary to deal with the question of age much more carefully and minutely. We have to examine the proportion of fatal cases after the lateral operation as occurring at *several different periods* of life. And I have dealt with this subject in a manner somewhat differing from that usually pursued. Thus it was soon obvious, in studying my figures, that little was to be gained by adopting the usual method of classifying the results of operation during periods of life artificially fixed, as from 1 to 10 years, 10 to 20, 20 to 30, and so on, the product of which is extremely deceptive. It was necessary

to examine every year separately, then to group the years, and to observe what natural indications the facts presented. The following plan, after many trials, appeared to me best adapted to afford the simplest and truest aspect of the subject at a single glance.

During the years	Cases.	Deaths.
1 to 5, inclusive. }	473, including	33, or 1 in 14½ cases.
6 to 11, inclusive. }	377, „	16, about 1 in 23½ „
12 to 16, inclusive. }	178, „	19, „ 1 in 9½ „
17 to 20, inclusive. }	76, „	11, „ 1 in 7 „
21 to 29, inclusive. }	86, „	11, „ 1 in 8 „
30 to 38, inclusive. }	75, „	7, „ 1 in 10½ „
39 to 48, inclusive. }	100, „	17, „ 1 in 6 „
49 to 58, inclusive. }	191, „	40, „ 1 in 4¾ „
59 to 70, inclusive. }	233, „	63, „ 1 in 3¾ „
71 to 81, inclusive. }	38, „	12, „ 1 in 3½ „
	1827	229

Now, then, taking this table, we see what Lateral Lithotomy is capable of effecting at early ages. At the earliest ages—the first year only excepted—one death occurs in about fourteen cases, the rate of mortality falling to one only in twenty-three cases between six and eleven years. As we pass from twelve to sixteen years, the death-rate rises, for during the period when puberty is declaring itself, as sexual activity becomes developed, we find the increased susceptibilities thus aroused, raising the mortality to one in nine and a half; and, from thence to the twentieth year, to one in seven cases. It improves but slightly up to the thirtieth

year, being until then about one in eight cases. As manhood becomes established and the strength increases, the death-rate diminishes to one in ten and a half between the thirtieth and the thirty-eighth year. But during the succeeding ten years, organic morbid changes beginning to set in, and the influence of continued depraved habits to tell on the constitution, the rate rises to one in six. These causes become more active, and at the same time the powers of life diminish, as age progresses from fifty to seventy years, the rate rising to one in four and three-quarters between forty-eight and fifty-eight, and gradually to one in three and three-quarters between fifty-eight and seventy, and finally to one in little more than three between seventy and eighty.

Now, regarding the question of age alone, we have seen how little temptation there is to employ Lithotrity, as a rule, below ten and eleven years of age. I believe Lithotrity has never offered any results at all comparable with these at this period of life. The propriety of employing it is, however, a matter for consideration between fourteen and twenty, but only if the stone is small and easily dealt with. It becomes still more so subsequently, as far as to forty years of age, under the same condition. But the period which follows, embracing all ages above forty years, is essentially the period for crushing the stone, that, during which we may derive the greatest aid from it, provided always, that some other considerations, which shall be discussed hereafter, are fully taken into account in dealing with individual cases.

I have another table of cases, to show the prevalence of calculus at the different periods of human life, which, from the extreme care taken in obtaining the records and in rejecting particular experiences, such as those of opera-

tors of eminence before referred to, is, I believe, as exact an exposition of the subject as could be obtained. (See end of Chapter XII.) The following facts appear from its analysis.

First. That one-third of the entire number of cases occurs during the first six and a half or seven years of life.

Second. That one-half of the entire number occurs before the thirteenth year is completed.

Granting that Lithotomy should be employed in childhood and boyhood, as a rule to which there are few exceptions, it follows that this method must be applicable to fully one-half the entire number of calculous cases.

What is, then, the period of life when the individual is most liable to be affected with calculus? It has been common to answer in childhood. A very superficial glance at these figures might confirm some reader in this opinion. I believe, however, that it is the period between fifty and seventy years, and of this the latter half of the term especially. That is to say, the proportion of elderly calculous patients to the existing population at their own ages is larger than the proportion of children afflicted is to the number of existing children. This is the only accurate method of viewing the question. Calculus is most common between fifty and seventy; appears in the next degree of frequency between two and six years; and least frequently of all, perhaps, between twenty-six and thirty-six years—when, indeed, it is rare.

2. It is necessary to ascertain the absence or presence of local disease. Malignant disease of the bladder, for example, would generally be held to contra-indicate any operative interference: not necessarily so, however. One of the cases in the University College series was an instance in which intense suffering was greatly relieved by

Lithotomy, and it apparently lengthened the patient's life. Such an instance is exceptional. Lithotrity, however, would be wholly out of place in such circumstances.

But by local disease here is mainly intended organic changes in the kidney; severe or persisting cystitis; enlargement of the prostate, and stricture of the urethra.

With regard to the first named, it is not very common to find calculus associated with those systemic changes which manifest themselves in the production of either fatty deposit, or those degenerations of structure commonly known as Bright's Disease, and the existence of which is evidenced by persistent albuminuria, renal casts in the urine, and, in advanced stages, by dropsical effusions in the cellular tissue, and in derangements of the cerebral functions. If such evidence is present, the stage of the disorder must guide us as to the propriety of entertaining the question of affording operative relief of any kind. No condition is more unpromising for the success of any operative procedure than that which has just been indicated. But, putting it aside, there is another class of renal affections not to be confounded with these blood disorders, in which the organic change in the kidney results from pre-existing irritation of the bladder, or urethra. We commonly meet with patients, the subjects of chronic nephritis and pyelitis, who owe the existence of these complaints to an obstinate stricture, to chronic disease of the prostate, or to a calculus which has long remained in the bladder. We find in the most-advanced cases of this kind, after death, the kidney greatly diminished in size, the cortical substance especially so; interstitial deposits, and often small collections of pus in the renal substance, while the pelvis may be dilated, and, in some cases, is enormously so.

Such are the results of mechanical distension from obstructive disease of the urethra and neck of the bladder, accompanied, as it always must be, more or less, by chronic inflammation extending up the urinary track. And it is with this type of disease that we have ordinarily to deal in discussing the question of operative procedure. Now the signs of this pathological state are not so clear as those which belong to the blood disorders above referred to. Furthermore, they cannot be distinctly isolated from the symptoms which belong to the urethral or vesical disease from which they derived their existence. They are not, by any means, to be discovered by urine-analysis; but their existence is to be inferred from symptoms which after all are by no means to be regarded as pathognomonic in their character. The patient complains of pains in the back and loins, and often in the groins and testicles; is probably tender on one or both sides on deep palpation through the abdominal muscles in the region of the kidney; is rather emaciated, and has gradually lost flesh; is weak and depressed, subject to chills and feverishness, amounting to rigors sometimes, after slight irritations, after the use of a catheter and the like. The urine is variable in its quantity and characters, and always contains pus, sometimes in great abundance.

3. This group of symptoms leads us insensibly to the next class of phenomena, viz., those which indicate considerable susceptibility to general disturbance from sources of local irritation, no organic disease whatever existing. There are many cases indicated in this division, in which extreme tendency to rigor exists, not on account of any existing renal implication, for, as before said, none may be present, but from some other and less obvious cause.

There are some constitutions, in which the nervous system appears to be so susceptible, as we express it, that almost any mechanical interference with the urethra, or bladder, is followed by startling symptoms obviously depending on some kind of shock propagated to the nervous centres, and consisting in syncope, rigor, vomiting, depression, with intense pains in the back, loins, and elsewhere. These, although alarming, are, generally, not dangerous, unlike those symptoms which, closely resembling them, depend on organic renal disease. Now, in none of these cases, is it usually desirable to attempt the removal of a stone, unless it be a very small one, by any method which requires repeated manipulation in the bladder or urethra. It is better, as a rule, to deal with it by one operation, than run the risk of several, and of the various minor difficulties which the removal of débris may involve.

Nevertheless, much more may be done with the last-named class than with the first. The cases belonging to it are improveable by general management, whereas those of the first steadily grow worse with time. But we again see here, incidentally, the value, the extreme value, of the preliminary treatment already referred to, and which I now repeat, and insist on even more strongly than at the outset.

It may thus be briefly summed up :—

Preparatory treatment is important, in view of any operative procedure by Lithotomy or Lithotrity; but especially is it desirable to pass a few times sounds of gradually-increasing calibre, to accustom the urethra and bladder to the contact of instruments, to lower its sensibility, and to increase its calibre, particularly before the commencement of Lithotrity.

By this practice we not only prepare the way for the passing of the lithotrite inwards and of fragments outwards, but if any undue excitability of the system, such as that just described, exists, its effects will be elicited in a minor degree by these preliminary measures before we have broken up the stone, and have become, perchance, committed, or nearly so, to the operation of Lithotrixy. If we discover undue sensibilities which are aroused rather than assuaged by instrumental interference, we shall do well to adopt Lithotomy. And in all cases, it is unwise to enter hastily on Lithotrixy before this condition has been determined by the employment of means which are equally valuable, whether they act as preparatory to Lithotrixy, or as a test for latent peculiarities in the constitution, which may contra-indicate it.

With these brief preliminary remarks, the way is now cleared for some final deductions relative to the operations to be employed in the various cases met with in practice.

1. For all cases of calculus during the periods of infancy, childhood, and boyhood, which may be regarded as from one to twelve or fourteen years, the following course appears to be the most judicious:—

To practise Lateral Lithotomy as the rule; the mortality from which varies during this period from one in eleven to one in twenty-eight cases; the mean of the whole being about one in fifteen cases.

The exceptional cases are those in which the stone is only a little too large to pass by the urethra, and therefore small. For these, there is no occasion to perform Lithotomy. Opposed as I am to Lithotrixy in children, *as a rule*, for reasons already named, I nevertheless believe, when the stone is so small as to be easily pulverized by a single

crush of a slender lithotrite, it is the simplest and best method of proceeding, and that when the stone can be well and easily crushed in two or three sittings, it is admissible.

With regard to Median Lithotomy in children, there appears to be no objection to it, provided a director or gorget conducts the finger into the bladder. At the same time, I do not know that it offers any particular advantages.

2. In adult cases we have to decide between Lithotomy and Lithotrixy; and if the former is indicated, to point out the particular form to be employed.

First, Lithotomy or Lithotrixy?

The special indications for these operations must be considered as they relate to two separate classes of patients.

a. In tolerably strong and healthy adult patients.

b. In feeble and diseased adult patients.

This division is of more practical value than a division founded on age, because the influence of age is less strongly marked after manhood has been attained than before. If age be regarded alone, the period between twenty-five and forty years gives the best results, viz. one death in eleven and a half cases, from Lateral Lithotomy. But the data are comparatively few, since it is the period of all others when stone is most rare. The question of age and its effects in adults is therefore included in the major one of constitutional conditions.

1. In the class of healthy adults.

If the calculus is of small or of medium size, and single, whether it be soft, friable, or compact, and supposing it proved by preliminary examination that instrumental manipulations can be easily performed and are well borne, it should be crushed.

But the term "medium," here used in relation to size, although admitting of a little extension for calculi of uric acid and the urates, must be restricted quite within the limits assigned, for those of oxalate of lime : their spheroidal general outline makes a medium-sized calculus (one inch in diameter), quite large enough, if not rather too large, for Lithotrity.

If there is any special or exceptional ground for rejecting Lithotrity in such cases, some form of central perineal operation is well adapted to them. The median if the stone is small or medium, the medio-bilateral if it is of full medium size ; the latter offering more room at small risk when it appears to be required. Probably the result by Buchanan's operation would be equally good, its present achievement in *adults* is eight cases with one death. The median in *adults*, from Mr. Allarton's collected cases, has given one death in seven ; the lateral, from 510 cases of *adults*, in my own table (but including stones of the largest size), one death in five and a quarter cases. If, on the other hand, the stone is large, and especially if it be also one of compact structure, the lateral operation would generally be the best to select. For a large and friable stone Lithotrity may be successful, but such an one offering between twenty-five and forty years of age would probably be as well dealt with also by Lateral Lithotomy.

2. The question is to be considered for feeble and diseased patients.

a. Where there is no marked disease of the urinary organs, but feeble and failing strength :—

If the calculus is of small size and friable, and instrumental contact is well borne, there is no question that Lithotrity should be the operation selected. If of medium

size, one would also incline to perform it, if possible, but if hard and compact in structure, Median or Medio-bilateral Lithotomy would probably afford better results.

b. Where well-marked disease of some portion of the urinary organs exists.

In stricture of the urethra, especially if it has existed long, and is well marked, Lithotomy is preferable to Lithotripsy in all cases but those of the smallest calculi.

In hypertrophied prostate, with a quiet condition of the bladder, Lithotripsy is successful in small and even with medium-sized stones. But with an irritable condition of bladder, and with compact and large stones, Lateral Lithotomy seems preferable, and, in such, seems more successful than median operations.

In cases where the bladder cannot expel its contents on account of loss of power in its coats, *i. e.* atony, and not on account of enlarged prostate, no objection lies, on that ground merely, against Lithotripsy: indeed, such a condition is much more favourable to success than that of undue irritability of the organ. This is now known to most practical lithotritists, although it is a condition which, not long ago, was held to contra-indicate Lithotripsy.

In marked disease of the bladder, cystitis with constitutional disturbance, tumours, simple or malignant, or if the existence of sacculi may be suspected, Lithotripsy is generally inadmissible.

Finally, for cases of either class where the stone is of extremely large size, such as are now rarely met with, say from four ounces upwards, I doubt whether experience can indicate, on the whole, a safer method than the lateral operation. We have seen Mr. Crichton's results, *viz.* eleven cases with two deaths. At University College Hospital,

Mr. Liston employed a double incision of the prostate, *i. e.* an incision of the right lobe as well as of the left, in Lateral Lithotomy, for nine cases of unusually large stone, losing two.

The high operation offers, perhaps, as good a chance, if the bladder be distensible, and the patient is not corpulent. Data, however, are wanting to determine the value of this as well as that of the recto-vesical operation in relation to extremely large stones. Probably the latter might be regarded as the better procedure were it not for its liability to be followed by permanent fistula.

There is a question inevitably presenting itself sometimes, which is rarely dealt with by surgical writers, *viz.* should we ever refuse to perform an operation for the relief of the calculous patient, and if so, under what circumstances? In practice, this question must be answered; and the manner of answering it influences very much the rate of mortality resulting from operative proceedings. I think in England and in Scotland very few cases are rejected as unfit for operation, certainly in hospital practice; in private there are, from various causes, more examples of unremoved stone. So much may be done to mitigate suffering for those whose means enable them to command every resource available for the purpose, that the alternative of an operation, rendered hazardous by the magnitude of the calculus, or other unfavourable circumstance, is not necessarily adopted. It is widely otherwise with the poor, and it is sometimes a nicely-balanced point to determine whether continuous suffering or a severe operation involves the graver consequences to life. Mostly the patient himself desires to turn the scale in favour of the latter alternative rather than be abandoned to the hopeless prospect of unrelieved

suffering. In France a larger proportion of cases is, I think, rejected. Lithotomy is not so successful there, on comparing the results, in large numbers, of practice in the two countries; and the operation appears to me to be more dreaded by both surgeon and patient. It is more rarely performed, and thus it is, perhaps, that there seems to exist a want of that confident familiarity with Lithotomy which distinguishes the practised English operator, and which doubtless conduces to success. On the other hand, those who practise Lithotrity in France appear unwilling to hazard its application to very unpromising cases, and no doubt they act justly and prudently in so doing. Take, for example, the practice of my esteemed and kind friend, M. Civiale, during the last year. It is a fair specimen of his usual experience, which he is good enough to send me annually, and has of late presented to the Académie des Sciences. He treated during the year 1862 sixty-nine calculous patients; sixty-six men, two women, and a child; forty-five in private practice; twenty-four at Hôpital Necker. Fifty-eight of these were operated on: forty-five were submitted to Lithotrity; of these eight were partially cured: and it was successful in all the remainder but one.

Ten were treated by Lithotomy; three were cured, two relieved, and five died. Three were treated by a combination of Lithotomy and Lithotrity; two were cured, the other has incontinence of urine.

In *eleven cases* operative means have been adjourned or considered impossible.

Now, although the Lithotrity here recorded is extremely successful, every English surgeon will feel surprised to find one in every six adult cases placed in the category last

named, and one-half of the Lithotomy cases fatal. It must be obvious to all who are familiar with the practice of this country, that nothing like this proportion of cases is adjudged unfit for operation.

Are they, or are we, right in thus acting? Without entering upon a discussion of the numerous topics which the answer to this question might give rise to, I shall simply appeal to the results of English Lithotomy in the very worst cases, viz. those of large stone and broken-down constitution. If such an appeal shows that one out of two or three recover, and it does so, I think we are justified in offering that chance to a patient whose only other prospect is a lingering death, greatly aggravated in its misery if his circumstances are narrow. There is one condition, perhaps, which must be held as sufficient ground in a bad case, such as described above, for refusing to operate, and that is the presence of advanced renal disease; and when this can be affirmed to exist, I think it may be said that such a patient will certainly die, and that the surgeon is not justified in accelerating his fate. There are, however, a good many examples among us, in private practice particularly, of patients who resolve not to risk any interference. I have had under my own care four patients, all at an advanced age, so greatly relieved by the daily use of the decoction of *Triticum repens*, that they have (in two of the cases I think unwisely) declined to submit to any operation. Certainly I have seen no circumstances in which that useful agent is more valuable than in those of calculus, sometimes when it is in the kidney, but especially when it is in the bladder, and I have received similar testimony from several of my professional brethren.

The foregoing observations, then, will be sufficient to

enunciate the general principles which extended observation and experience indicate, in my opinion, to be our guides in selecting the proper procedure for given cases. Nevertheless, it is not presumed that every example can be brought to rule and measure, so to speak, and be mathematically fitted to the process requisite for it. Let it be well understood that they are held forth as principles to indicate the way, not as rigid laws, knowing no exception. By some, I am aware, I shall be charged with limiting the application of Lithotrity. No doubt more is *possible* by that process. I doubt whether it is prudent to push it further. *It must be our aim to reduce the stones to the process; that is, to detect them early, and consequently small, rather than to extend the process to large and compact stones.* It is true that a stone of that character may be removed, in certain exceptional cases, by Lithotrity, where great tolerance of manipulation by the bladder is exhibited. I may be permitted to allude to one, as an example, perhaps the largest of its kind ever removed by crushing in this country, in the practice of my friend Mr. Coulson, since I had the pleasure of operating during his absence on several occasions. Not less than three and a quarter ounces of exceedingly compact uric acid stone were removed in that case with success; the patient's age being eighty years, and his power of emptying the bladder lost.

But this is wholly exceptional, and not to be regarded as a precedent. Had his bladder been irritable, instead of unable to expel its contents, the result would have been impossible. I believe that it is certainly true that an undue attempt to extend the province of Lithotrity beyond moderate limits will produce nothing but disaster.

I do not know that I could offer a more pertinent illus-

tration of the manner in which I would apply the principles here laid down, nor better exemplify that they are not mere theories on my part, but have been carried into practice, than to present a certain number of cases which have occurred in my own patients, each one of which bears forcibly on some one of the principles referred to; and I desire to point to no better result of their application than the cases in question form. These, with the brief clinical remarks which are necessary, will form the succeeding and final chapter of this work.

I must also call attention to the advantage of discovering calculus in the early stage, of which several of these cases are examples. Some years ago I brought this subject forward at the Medical Society of London, reading five cases, with the view of illustrating what appears to me the great importance of this practice. For I do not hesitate to affirm that Lithotrixy for a small, compact, or friable stone occurring in a tolerably healthy subject, devoid of unusual local susceptibility at any age above puberty, is, if properly performed, an operation almost wholly devoid of danger. Such a statement cannot be made of any other mode of operating for stone. (*See Cases 1 to 7, Chapter XII.*)

It follows then,—since every calculus is during a portion of its history small, and passes, generally, not very rapidly, through the early stages of formation; and since deteriorated health much more frequently succeeds to than accompanies its formation,—it follows, I repeat, that calculus of the bladder is removable, if its presence be early diagnosed, in almost every case, with very little danger.

No proposition can be more logically incontrovertible than this: yet the practice of the past, so far as it depends

on diagnosis, though steadily improving, has done so by slow and gradual degrees. Its truth, however, pregnant as it is with the happiest results for humanity, only requires to be known and acted on, in order to achieve at once a great advance, and one which I am sure is within our reach. In this department, as in every other of the wide domains of medicine and surgery, diagnosis is the one thing needful. That diagnosis is slowly reducing the size of the stone year by year, and has been doing so during some past time, is demonstrable from our museums. Take that of Norwich, for example, which is, thanks to the surgical genius of East Anglia, the most perfect and complete record, literally "graven in stone," that the world possesses of calculous experience! When the art of surgical diagnosis was young, the stone was often overlooked, until its large size and long existence precluded the possibility of the oversight continuing. Hence, among the stones, removed there in the end of the last century, are seen masses which now most rarely come to light. I calculated the sizes presented during each consecutive ten years down to the present time, and noted the significant fact that they are gradually decreasing in size. In other words, it has been successively true at different periods, that the stone now is detected in an earlier stage of its existence than formerly.

Thus the first, or earliest, 100 stones in the

Norwich Museum have an average weight	dr.
to each of	8·64
The second 100	7·07
The succeeding 400	5·95

But how much too late is still the stone detected! Ought any man, who complains of his symptoms, within reach of

competent skill, to carry a stone in his bladder for more than twelve months, nay, more than eight, or six? And if detected thus early, if discovered when it assumes the size of a bean, or at most that of an almond, how often would it be necessary to lithotomize an adult? There can be no doubt that skill in diagnosis is greatly on the increase, and, from this fact, I may venture to foretell, without any pretension to the gift of prophecy, that year by year the stone will be detected sooner and sooner still, and that, therefore, "*pari passu*," Lithotomy will become less necessary, and Lithotrity more often applicable. Add to this, the fact that the unchangeable conditions of anatomy leave little more to be effected, probably, in the mode of removing stone by the knife, while the improved application of mechanics to Lithotrity is, year by year, perfecting the process.

I say little here of chemical solvents in the treatment of already-formed calculus. Of some service, in exceptional cases, they, undoubtedly, are. But their special application is to the earlier stage of the calculous diathesis, antecedent to true stone formation; for the solution of those particles, which, aggregated, form the stone. For the action of solvents we require minute mechanical division of the material to be acted upon. And here we have it. It is but one step further still in the application of diagnostic science, which recognizes in the persistent undue deposit of crystalline material in the urine, and certain associated symptoms, that calculus-formation is imminent or impending; and internal solvents arrest the formation of precipitated deposit, while the erring tendency of the economy is gradually corrected by medical treatment, diet, and hygiene. But of this, enough; for the terms of my

subject are purely surgical, and there is no further need that I overstep that imaginary line which is supposed to trace the confines of medicine and surgery. A subject, which, nevertheless, illustrates well the important truth that no man can be a good practical surgeon who is not also an intelligent physician.

CHAPTER XII.

ILLUSTRATIONS OF THE APPLICABILITY OF THE PRECEDING PRINCIPLES TO PRACTICE.

Cases illustrative of the Importance of early Diagnosis while the Stone is small, all cured by Lithotrity.—Cases particularly adapted to Median Lithotomy.—Ditto in Children.—A Case of Medio-bilateral Lithotomy.—Lateral Lithotomy in very large Prostate.—Lithotrity in advanced age, and where Lithotomy was inadmissible.—Lithotrity in a Boy.—Ditto in a Girl.—Case in which the indications were equally balanced for the two operations; Lithotrity performed.—A Case where power of Micturition was lost from simple Atony; Lithotrity successful.—A Case where it was lost from greatly-enlarged Prostate; Lithotrity successful.—Table of 1827 Cases showing the comparative prevalence of Calculus during each year of life.

I HAVE selected from my own practice twenty cases, including twenty-one operations—fourteen of Lithotrity and seven of Lithotomy—for the sake of affording a practical illustration of the principles arrived at in the foregoing pages. Each has been chosen as bearing on some particular point in relation to the calculous patient, and where one illustration serves the purpose I have not made the chapter unnecessarily prolix by citing two.

To this remark there is one exception. It is impossible, in my opinion, to insist too much on the immense importance of detecting the stone in its early stage; indeed, on the ability which the surgeon possesses to reduce that dire disease, vesical calculus, almost to harmless proportions. Hence, in order to demonstrate sufficiently my proposition,

I append seven examples of small stone previously not suspected to exist, but detected early, and crushed at one or, at most, two sittings; and several more might have been added. I must confess to derive more real satisfaction from one of these cases (and this is putting the statement in its strongest form) than from one of those in which the far more imposing operation of Lateral Lithotomy successfully relieves a patient from a large and long-existing calculus. The time will come when the existence of such a calculus will be deemed, as it really is, an opprobrium to medicine.

CASE No. I.

SMALL OXALATE OF LIME CALCULUS: LITHOTRITY—CURE.

H. A., aged 36, a porter at Pickford's, supposed to be the subject of stricture, was sent to me as an out-patient at University College Hospital, Feb. 25, 1859, with some symptoms, not very urgent, of urinary derangement. I passed an instrument, and found no constriction, or other cause for his complaints, in the urethra or prostate; but sounded him, and discovered a small stone. His urine was examined, found healthy, but depositing octahedra of oxalate of lime. He was directed to come at my next visit, March 1, when I introduced a lithotrite, and crushed at once, in the out-patient's room, a calculus about the size of a nut; he had no chloroform. There were no traces of bleeding, and no signs of irritation following; consequently, after an hour's rest, I desired him to walk slowly to Camden Town, where he lived. A succeeding crushing followed on the 6th, and a final exploration on the 9th of March, small débris passing easily after each sitting. The calculus was oxalate of lime. Being perfectly relieved of all his symptoms, he returned to his work at Pickford's, as night porter, on the 16th of March, being the fifteenth day from his first sitting. He has continued at work ever since, and is perfectly free from all his old symptoms, having recently called at the hospital to tell me so.

CASE No. II.

URATE OF SODA CALCULUS: LITHOTRITY—CURE.

A gentleman, aged 45, was under my care, in September, 1858, for stricture of the urethra, which was successfully treated by dilatation in the ordinary manner. Some symptoms of urinary derangement remained after No. 11 sound had been reached, which evidently demanded further investigation. Accordingly, I introduced a lithotrite, and, after some searching, discovered a calculus, measuring three-eighths of an inch, according to the scale of the instrument: I crushed it at once at the patient's rooms.

Next day, Oct. 12, some fragments of urate of soda passed, and débris followed on succeeding days.

Oct. 19. Again crushed two or three fragments. After three days no more débris passed, and the symptoms disappeared. A week afterwards the patient was carefully sounded, but nothing was discovered. He has been perfectly free ever since. The calculus was urate of soda.

CASE No. III.

SMALL URIC ACID CALCULI: LITHOTRITY—CURE.

A gentleman, aged 39, while staying in Malta on his return from India, was recommended to consult me by my friend Mr. Filliter, then in practice there. He had suffered for some months from irritability of the bladder, and severe pain after passing urine, with occasional pains in the back and loins. There had been no bleeding observed, and no pain in the glans penis. Instruments had been passed in India; no stricture was discovered. The general health was somewhat impaired. I saw him first on Oct. 16, 1857, and suspected the presence of stone, and it was agreed that he should be sounded in a few days. The urine was examined by the microscope and blood corpuscles seen.

Oct. 24. I introduced a lithotrite, caught a small stone, and effectually crushed it. He was in bed, and remained so during the day.

Oct. 25 and 26. Some irritability of bladder; several fragments came away; there was no fever.

Oct. 29. Better. I introduced the lithotrite, and found one fragment, which was crushed.

Nov. 1. More débris has been passed.

Nov. 15. Left perfectly well.

CASE No. IV.

URIC ACID CALCULUS: LITHOTRITY AT TWO SITTINGS—CURE.

A gentleman, aged 64, consulted me in Nov. 1861, respecting the following symptoms:—slight frequency of making water; occasionally a little blood after exercise, especially on horseback; *no pain whatever* at any time. Has passed small calculi occasionally. Prostate slightly enlarged. No urine left in the bladder after micturition.

I sounded him, and found a small calculus, which gave a sharp ringing note, and advised Lithotritry. A fortnight afterwards I saw him with Mr. Tatham, of Brighton, and crushed a small, hard, uric acid calculus, finishing it at a second sitting some days after the first; I used in both Charrière's lithotrite with plain blades. He had no chloroform, made no complaint of pain, passed the débris by the natural efforts, and had no unfavourable symptom of any kind. I advised the daily use of citrate of potash for a considerable period to neutralize a free deposit of uric acid, while attention was paid to the functions of the liver, skin, &c., with the view of correcting the tendency as much as possible. He enjoys excellent health, and has had no recurrence of the complaint.

This Case illustrates the fact that absence of pain does not necessarily contraindicate the employment of the sound, although it is very rare indeed that calculus is present without it.

CASE No. V.

SMALL OXALATE OF LIME CALCULUS: LITHOTRITY, ONE SITTING—CURE.

J. L., a young man aged 23 years, was sent to me at University College Hospital, for supposed stricture of the urethra, in the beginning of March, 1862.

He had suffered from frequent and painful micturition about four or five months, with occasionally a little blood in the

urine after exercise. On sounding him I found a small calculus. The urine contained a little pus and blood, and numerous octahedra of oxalate of lime.

March 19, 1862. He was brought into the operating theatre, and placed on the table without chloroform, or preliminary injection. He had been directed to retain his urine for one hour and a half previously. I introduced a lithotrite with plain blades, found a very full bladder, and was unable to discover the calculus. He then told me he had held urine for four hours through misunderstanding the directions; I withdrew the instrument and desired him to pass some urine at once, which he did. Re-introducing the lithotrite I instantly caught and crushed the calculus, three or four times successively, stating that I had, to the best of my belief, pulverized the whole. There was no bleeding, and the patient uttered no complaint whatever.

Next day he was a little feverish, and passed small débris abundantly, which proved to be oxalate of lime. This he continued to do during the next two or three days. He lived as usual, but remained for the most part in a recumbent position. All the symptoms of stone disappeared in less than a week, when he walked about as usual. A few days afterwards I sounded him, but found no fragment remaining; and he was discharged on the 10th of April, having been detained only for the purpose of watching for any return of symptoms.

The whole of the débris passed in a pulverulent state, and was evacuated solely by the act of micturition; the bladder never having been washed out, and a scoop never having been introduced.

He has been perfectly free from all return until this date (Feb. 1863), being now under my care for syphilis at the hospital.

CASE VI.

SMALL URIC ACID STONE: LITHOTRITY—ONE SITTING—ATONY OF THE BLADDER—CURE.

A gentleman, aged 56, first consulted me in June, 1862. He has been subject to lithic acid deposit for some years. His father had calculus of the bladder, and died of it.

In February, 1862, he passed a small calculus nearly as large as a pea; and the frequent micturition, to which he had been subject a short time previously, disappeared. Since that smaller ones have been passed. These ceased to be formed, on taking citrate of potash two or three times a day, at my recommendation for a few months, combining it latterly with citrate of iron.

In the autumn he discontinued the use of the potash. In November, 1862, he had severe pains in the back and in micturition. Attacks of difficulty and pain in passing water, especially when taking exercise, also recurred from time to time.

February 17, 1863. I sounded him, and found a small calculus.

February 19. I crushed this easily at one sitting; my friend, Mr. Berkeley Hill, being present. There was no bleeding after the operation. The calculus was uric acid.

Débris passed on the 20th and 21st; and there was not a single symptom of any kind produced by the operation, or by the passing of fragments.

February 23. Sounded carefully; no fragment detected. To go home in a day or two.

February 26. No symptoms have appeared; he has taken moderate exercise, enjoyed his meals, and is on the point of returning to the country; but this afternoon has experienced a little difficulty in passing water. He used hot fomentation, and relieved it.

February 27. As yesterday.

February 28. Retention; I drew off, with a No. 10 gum catheter, twenty ounces of urine with great ease.

March 1. Sent for in the night, on account of retention.

March 3 and 4. He has been passing very little water by his own efforts, requiring catheterism for three-fourths of the quantity.

March 5 and 6. No urine passed by his own efforts; he is learning to use the catheter for himself. There is no inflammation; urine clear and healthy; feels weak; to have strychniæ gr. $\frac{1}{4}$; tinct. ferri sesquichloridi m. xx.; ter in die sum.; cold dash to abdomen two or three times a day.

March 9. His strength is improving: and in all respects, he is well, excepting only the inability to pass urine otherwise than by catheter.

On the 16th, the bladder began to recover tone, and by the 20th regained it almost completely; to prevent any danger of distension, he continues the use of the catheter for the present, night and morning; one ounce only of urine remains after micturition.

At the end of the month, there was scarcely any residual urine at all.

CASE VII.

CONSTITUTIONAL DISPOSITION TO PHOSPHATIC URINE—A SMALL CALCULUS IN 1857: LITHOTRITY—A LARGE ONE IN 1859: LITHOTRITY—IN BOTH INSTANCES SUCCESSFUL.

A gentleman, aged 31 years, was brought to consult me, by my friend, Mr. Tweed, of Brook Street, on September 8, 1857. During the last eighteen months he has suffered severely from urinary derangement; and for fifteen months there have been fistulæ in the perineum. In France, where he resided during the summer, he was advised to pass all his urine by catheter, in order to give them a chance of closing. He did so, and with the desired effect. They have since, however, re-opened, and they exist now. On examination, no stricture, nor any disease of the prostate, is detected, and there appears no reason to believe that either has existed. I then introduced a sound, and discovered a small calculus.

The next day, September 9, he paid me a second visit, when I introduced a lithotrite, and crushed at once a small calculus, about the size of a bean. He walked home to his house in Brook Street. During the week he passed phosphatic débris.

September 16. Introduced a lithotrite, but could find nothing in the bladder. Symptoms continue, although diminished in intensity.

September 22. Again introduced the lithotrite, found a small piece, and crushed it. The débris passed next day.

October 1, 1857. He left town perfectly free from symptoms. After this he completely recovered, and enjoyed excellent health for more than a year. He had, however, wholly neglected to adopt a system of diet and medicine, which we were anxious he should follow perseveringly, as a constitutional tendency to form phosphatic matter existed, the urine being still always alkaline and phosphatic.

In May, 1859, he reappeared with a calculus of considerable size, and in completely broken health, having suffered severely about six months. The fistulæ had re-opened, urinary retention had several times occurred; he passes water every hour with extreme pain; and has orchitis and constant fever. The urine is exceedingly offensive, and is loaded with pus and mucus. I gradually got him into better condition, locally and generally, by tonics, generous diet, and washing out the bladder; and crushed his stone for the first time on June 2. It was a large phosphatic one, and was removed in six sittings, the last of which was on July 7. On the 20th he went into the country quite well.

After this he went to reside in Spain. I saw him again in the summer of 1860, and again in that of 1861. His health was impaired, but he had no signs of stone. He died with disease of the kidney in the summer of 1862 at Barcelona; an autopsy was made, and the bladder found perfectly free from stone.

The next three cases are examples of formations in the bladder, which, so far as their size was concerned, were quite amenable to Lithotrity, might possibly have been so treated, and probably would have been submitted to it in Paris. In each I venture to think there was sufficient reason for preferring Lithotomy. The first patient was the subject of old stricture; this was fairly dilatable and could be brought up to No. 9; but his age was very considerable, I thought the powers of life less likely to be injured by Median Lithotomy than by the more prolix

and perhaps troublesome proceedings which Lithotrity in such circumstances would require ; and so it turned out, for he made a rapid recovery.

The second was a perfectly satisfactory operation, in performance and result, as far as everything belonging to it was concerned : the patient never experienced an untoward symptom in connection with any pelvic or abdominal organ. But he died (cured of his stone), in the fourth week, from an attack of cerebral disease. He had been unusually excitable for some months past ; and this determined me not to undertake Lithotrity, and I still think the choice was correct.

The third patient had a mass of sealing-wax in his bladder, with much phosphatic matter ; and the reason why Lithotrity was inapplicable is stated in the account given. Median Lithotomy effectually relieved him.

CASE No. VIII.

CALCULUS OF MEDIUM SIZE—STRICTURE OF THE URETHRA—
AGE 72 YEARS : MEDIAN LITHOTOMY—CURE.

A naval officer of high rank was recommended to consult me by my friend Mr. Case, of Fareham, Hants.

He was 72 years of age, and had suffered from symptoms of stone for a year or year and half ; but taking much care of himself, these were not very severe ; moreover, they had been much mitigated by the use of the *Triticum repens*.

December 17, 1862. I sounded him for the first time, and detected one, or perhaps two, calculi. He had been the subject of stricture, and had passed instruments for himself, for about forty years, so that although I could introduce a sound of moderate size I could not introduce a lithotrite, unless it was one of very small calibre. His health was good, and I proposed Lithotomy by the median operation.

Dec. 23. Mr. Erichsen holding the staff I dissected

down to it in the middle line, gently dilated the prostate, which was very rigid, with my finger, passed the forceps after withdrawing it, for I could not pass them upon it, so undilatable were the tissues. I withdrew it with two pyramidal calculi, each about the size of a hazel nut; and reintroducing it seized a third which broke in the extraction; all proved to be phosphatic. The bleeding was free, and I plugged round the tube.

He did remarkably well; the wound healed by the 14th of the succeeding month, and on the 21st he left for the country in good health, and perfectly free from his former symptoms.

CASE No. IX.

CALCULUS OF FULL MEDIUM SIZE: MEDIAN LITHOTOMY—
DEATH FROM CEREBRAL DISEASE.

A gentleman, aged 68, consulted me, Oct. 31, 1862. He had had symptoms of calculus for some time: he was the subject of chronic bronchitis, and of extremely excitable temperament. I sounded him, and found a medium-sized calculus.

Nov. 1. He saw me again, and expressed a very strong desire to get rid of his sufferings, which were extremely severe, without delay. Taking into account his nervously irritable manner, I at once decided against Lithotrixy; and as he was physically in excellent health I advised Lithotomy without delay, selecting the median operation.

Nov. 3. Mr. Erichsen held the staff; Mr. A. Leggatt, of Knightsbridge, who had formerly attended him for his chest symptoms, and others, were present. I dissected down to the staff, introduced my finger, slightly dilating the neck of the bladder with it, then the forceps, and withdrew without the slightest difficulty a rough oval stone, about an inch and half long, covered with projecting processes of phosphatic matter. He had made water immediately before the operation; I had not injected, and the bladder did not contain an ounce. There were no vessels to tie and very little bleeding occurred: a tube was tied in as usual.

Nov. 10. No unpleasant symptoms of any kind have

appeared. He has taken solid food freely from the second day, and with relish. The relief from his previous suffering is very marked.

Nov. 12. He sat up for five hours, but he shows signs of unusual excitability and inability to sleep. We learn that these have occurred on previous occasions during the last few years; they are increased by all forms of opiate; alcoholic stimulants seem to be of service. The bronchitis has become troublesome. The wound is looking healthy; he retains his water four hours, and has no pain whatever there. Urine natural, no albumen.

Nov. 18. An attack of excitement occurred, indicating serious cerebral derangement.

Nov. 19. Much improved.

Nov. 21. A convulsive attack; with unconsciousness for half an hour; the effect of this was never recovered. He improved greatly the next day, and gave us hope of ultimate recovery. But on the 23rd he was weaker, and he gradually sank on the 25th. The wound caused by the operation had almost closed, and not a single symptom of derangement in the urinary organs had been experienced since the operation.

CASE NO. X.

A MASS OF SEALING-WAX IN THE BLADDER FOR SIX MONTHS: MEDIAN LITHOTOMY—CURE.

Mr. S., æt. 22, was admitted to University College Hospital under my care in Feb. 1861. He gave the following history. About six months ago, having suffered for some little time with slight symptoms of stricture, he made a bougie of sealing-wax and passed it into the urethra; on withdrawing he discovered that a portion, about three inches long, had broken off and remained within. He suffered much pain in passing water after this, had symptoms of cystitis, and those common to stone in the bladder, the latter more than usually severe.

On examination I found the urethra partially blocked with calculous deposit; I removed, by means of the slender urethral forceps, several pieces of calculus, having the appearance of

crusts detached from some other substance. This accomplished I sounded him, and found a foreign body lying on the left side of his bladder, but obtained no sonorous ring from it, as in the case of stone.

My first impression was that this, being sealing-wax, might be easily crushed. I took the precaution, however, first to try the effect of a lithotrite upon a mass of sealing-wax placed in a basin of water at a temperature of 100° Fahrenheit, and discovered that it was no longer friable; the lithotrite, instead of breaking it, merely kneaded it, and became dangerously clogged; I then decided to cut him by the median method.

March 13, 1861. My colleague, Mr. Erichsen, holding the staff, I performed the operation. On my finger entering the bladder I felt it everywhere surrounded by masses of mortar-like consistency. The forceps was of little service, but the scoop enabled me to remove a large quantity of phosphatic deposit, and fragments of sealing-wax partially disintegrated. These seemed almost to adhere to the walls of the bladder, and caused much trouble; some portions were high up behind the pubes, and I could only reach them when Mr. Erichsen made, at my request, firm pressure on the abdomen behind the symphysis. After a few minutes I succeeded in emptying the bladder, and in washing out all débris, and the patient was removed to bed. The bleeding had been free, and the tube was plugged. He did well, but had a smart attack of secondary hæmorrhage, ushered in by rigor, on the ninth day after the operation: it yielded to plugging and bladders of ice. He had no further check; urine ceased to pass by the wound on the 2nd of April; and he left cured at the end of that month.

The interesting points about this case were, the danger of applying Lithotripsy to a material like sealing-wax; the difficulty in extracting it when mixed with phosphates and occupying all parts of the bladder, and the recurrence of that somewhat rare event, secondary hæmorrhage.

The eleventh case is an example of Median Lithotomy in a child. I know of no advantage it possesses above the lateral operation at this age, all circumstances considered. The peculiar difficulty not unfrequently met with, but easily overcome, is illustrated by it. (See page 71.)

The twelfth case is an example of the same operation in boyhood, during and after which some surgeons consider the median incisions preferable.

CASE No. XI.

MEDIAN LITHOTOMY IN A YOUNG CHILD—CURE.

A child, aged $3\frac{1}{2}$ years, was admitted with stone under my care at University College Hospital, December 7, 1859.

Dec. 9. I sounded the patient with a lithotrite, catching at once a roundish stone, measuring $\frac{3}{4}$ inch in diameter. I could easily have crushed it, but three sittings at least would probably have been necessary, I therefore preferred Lithotomy.

Dec. 14. Mr. Erichsen held the staff, and I performed Median Lithotomy. Knowing the difficulty which is sometimes experienced in introducing the index finger into so small a canal as the child's urethra, after the incisions by this operation are completed, I passed a small tapering gorget, made very much after the pattern of Cheselden's, along the groove of the staff into the bladder; and was thus provided with an easy channel for the finger and forceps, removing the stone, which was like a marble, without difficulty. The child recovered rapidly, and left the hospital in about three weeks.

CASE No. XII.

MEDIAN LITHOTOMY IN A LAD—CURE.

H. R., aged 9 years. He had had symptoms of stone for two or three months, and came under my care at the Marylebone Infirmary in April, 1857.

April 20. I cut him on the median method, and extracted a uric acid calculus about the size of a bean. There was no difficulty here whatever. He made a rapid recovery, and was discharged in a few days.

The following case is an instance in which, when performing the median operation, and believing the opening insufficient for the removal of the stone, I converted it into the medio-bilateral by making the deep incision with the two-bladed lithotome, in accordance with the plan described in Chapter III., pp. 57-59.

CASE No. XIII.

CALCULUS OF FULL MEDIUM SIZE—LITHOTRITY ATTENDED WITH SOME DIFFICULTY—THE MEDIO-BILATERAL OPERATION—CURE.

A farmer, aged 39, was sent to me by my friend Mr. Cooper, of Canterbury, in November, 1861. He had had symptoms of stone for two or three years, but there had been difficulty in dealing with the case, inasmuch as it was by no means easy, from some circumstance or another, to sound him. Indeed, a positive assurance respecting its existence had not been obtained until I struck the stone on his visit to me. It appeared to be a middle-sized stone, and I proposed to crush it.

Nov. 7. Having divided the external meatus, which was unnaturally small, I endeavoured to seize the stone, but could not manage it satisfactorily. I struck it with the sound, it lay on the left side of the bladder, and its form could be very distinctly made out by the finger in the rectum.

Nov. 9. I made another attempt, and broke a small portion from it; but found the stone in the same place, and not so accessible or movable as usual. Three or four days after I tried again, but with an unsatisfactory result, the click obtained was never so distinct as I wished to find it. I therefore resolved to perform Lithotomy, and adopt the median incision.

Nov. 19. Mr. Erichsen obliged me by holding the staff. I cut down to it, and finding the neck of the bladder very tight and somewhat deeply placed, I introduced the two-bladed lithotome, and converted the median into the medio-bilateral operation. Introducing the forceps, I extracted two or

three good-sized fragments, but the remainder was distant, and apparently fixed. At my desire, very firm pressure was then made above the pubes, but I still failed to move it with the forceps. I then insinuated beyond it a full-sized scoop, and extracted without further difficulty. Bleeding was rather free, but soon ceased. He made a good recovery, left on the 10th of December, the wound being not quite healed. I learned afterwards that a slight fistulous opening remained for some months; he was, however, completely rid of his symptoms, and enjoyed perfect health subsequently.

The next case illustrates the applicability of Lateral Lithotomy, especially to cases of enlarged prostate (see Chapter XI., p. 237). Valuable as the median operation is for the adult with a healthy prostate, I am inclined to believe from the autopsies of some cases in which it has been applied where the prostate is the subject of senile hypertrophy, or is abnormally rigid (p. 105), that this organ is prone to split far back in the middle line rather than dilate under the efforts necessary to remove the stone, and so set up fatal inflammation and infiltration at the base of the bladder. I believe it, therefore, wiser to select the lateral operation, which permits incisions to be made sufficiently free for the purpose, without risk of dangerous rupture.

CASE No. XIV.

GREATLY HYPERTROPHIED PROSTATE—DISEASE OF THE BLADDER—PHOSPHATIC CALCULUS: LATERAL LITHOTOMY SUCCESSFUL.

A gentleman, aged 70. He had previously been under my care for considerable hypertrophy of the prostate, and retention of urine occasioned by it, but had not consulted me for some months, being able to pass his catheter when required. I was sent for by his usual medical attendant, Mr. Chard, Eccleston

Street, Belgravia, Nov. 9, 1861, to see him on account of great pain after passing water, increased frequency, and considerable mucous deposit in the urine, unrelieved by medicine. I at once sounded him, and found a stone lying behind the prostate, which was greatly enlarged. This being the case, and much cystitis being present, while the patient was very feeble and suffering severely, I advised Lithotomy without delay; and, on account of the condition of the prostate named, selected the lateral operation.

Nov. 14, 1861. Having reached the staff, I used a probe-pointed knife, but found my finger unable to enter the cavity of the bladder, though I could feel the projecting lobes of the prostate. I therefore introduced Dr. Keith's gorget, and upon it the forceps, and withdrew the stone without difficulty. It was about the size of a chestnut, and phosphatic. He lost very little blood during the operation, and almost none afterwards.

Nov. 17. The urine has been clear and abundant since the operation. Removed the tube to-day. Symptoms all favourable, but he is weak. To take nourishment freely and wine.

Nov. 27. He gains strength fast; a little urine passes by the penis.

Dec. 7. Has left his bed-room; most of the urine comes by the natural channel.

July, 1862. The patient made a good recovery, having soon regained health and strength, and ability to take exercise. He is still the subject of prostatic and vesical affection, and a very minute fistula remains in the track of the wound, due, no doubt, to the diseased condition of the neck of the bladder. The prostate has increased in size, and is extremely large.

The next case illustrates the advantages of preparation, and of very cautious procedure in the application of Lithotrixy to a patient advanced in years and feeble; in such cases success depends very greatly on what may be called the collateral treatment. (pp. 137, 141, and 233.)

CASE No. XV.

CALCULUS OF MEDIUM SIZE—PATIENT AGED 76 YEARS—VALUE OF PRELIMINARY TREATMENT : LITHOTRITY—CURE.

A gentleman, aged 76 years, was recommended by Mr. Gatis, of Wolverhampton, to consult me, June 27, 1860. He had passed blood occasionally, and had suffered from the usual symptoms of calculus for about two years. I sounded him, and found one of medium size. His health was tolerably good for his age, but he was feeble; the heart's action very weak, and he was not in condition for commencing any proceedings; still, there was no organic disease. I advised, therefore, due preparation, and then Lithotrity. Urine extremely acid, and depositing urates.

July 2. I introduced a sound to measure the stone; he felt faint: I removed the instrument at once; a slight rigor and pain in the back followed. He gradually recovered during the next two or three days. During this month I passed instruments from time to time, and improved the general health by every means in my power. During the succeeding month he went into the suburbs, and continued the same plan under the care of Dr. Webster, of Dulwich. In September he was decidedly better in every respect, and apparently in excellent condition for operative treatment.

Sept. 9. In the presence of Dr. Webster I crushed a uric acid stone, of medium size, with great ease. The patient had no chloroform, and felt no occasion for it. Everything went well, but the sittings, of which nine followed before the end of the year, were short, and conducted with great caution; the débris passing, for the most part, spontaneously.

Jan. 12, 1861. I was perfectly satisfied, after a final exploration, that his bladder was clear. His strength was much improved, his health good; he had walked a mile and a half without any discomfort, and held his water four hours.

I saw this gentleman in June, 1862; he was as well as ever, perfectly free from all symptoms, and he is so still.

The following is an example of one of those cases in which the conditions regarded as favouring the two proceedings of cutting and crushing, were so nearly balanced that it was not possible to pronounce decidedly for either. On the whole, I advised Lithotrity; the patient had come prepared to expect it, and wished it, if possible. Had I been acquainted with all the circumstances which the present advantage of retrospect affords me, I should have declared in favour of Lithotomy.

CASE No. XVI.

LARGE URIC ACID CALCULUS : REMOVED BY LITHOTRITY AFTER NUMEROUS SITTINGS—PATIENT SINKING SUBSEQUENTLY WITH ORGANIC DISEASE OF THE KIDNEYS.

A gentleman, aged 69, consulted me, November, 1861, with symptoms of stone of about three years' standing.

I sounded him, and found a hard calculus of full medium size, lying behind an enlarged prostate. I saw him, in consultation with Dr. Kirkes, of Bartholomew's Hospital, and we examined his urine. Each of us found crystalline deposit, a little pus, but no albumen or renal casts.

He was naturally rather nervous and irritable, and the heart's action was irregular. The appetite was very good; his habits of life had been active to the present time, and he looked healthy. Although his bladder was very irritable, obliging him to rise seven or eight times every night, there was no catarrh of the bladder, or general febrile symptoms. On the whole, although I regarded the indications for the cutting and the crushing operation pretty equally balanced, I decided in favour of the latter.

Nov. 29. The first sitting, under chloroform, by Mr. Clover, at the patient's wish.

Dec. 1. There has been no bleeding, nor have there been any symptoms of disturbance, general or local; some débris passed to-day.

Dec. 3. Some retention of urine, rendering catheterism necessary; warm hip bath; no fever; appetite good.

Dec. 5. The second sitting, as before.

Dec. 8. Much débris removed by washing, as the bladder acts feebly.

Dec. 11. The third sitting. These three sittings were conducted with the fenestrated lithotrite, and the stone is well broken into fragments.

Dec. 14. Some mucus in the urine; catheterism necessary.

Dec. 18. The fourth sitting; by a lithotrite with plain blades; much débris made.

Dec. 26. The fifth sitting; bladder losing power: urine drawn off night and morning: otherwise progressing well.

Jan. 2, 1862. The sixth sitting.

Jan. 6. Little feverish: much débris removed.

Jan. 10. Improving, but rather feeble.

Jan. 14. More fever, after a little exercise had been taken.

Jan. 18. Much better.

Jan. 22. The seventh sitting; the bladder is now almost emptied of calculous matter.

Feb. 3 and 11. On each day a little remaining fragment was crushed.

Feb. 13. Nothing now is felt in the bladder, except, perhaps, occasionally a small fragment on withdrawing the catheter, which it is necessary to pass four times a day, as he has lost the power of evacuating the urine. The appetite is less good, and the patient generally feeble; nothing in manner or appearance to produce anxiety, except the fact noted to-day for the first time that there is a considerable amount of albumen in the urine.

I had enjoyed the advantage of Dr. Kirkes' constant attendance and advice throughout. We directed our attention to relieve, by every means in our power, the renal derangement, which was threatening to be serious. The patient, however, gradually flagged during the next week: at times he was drowsy; at others, he was so much better, as to give hopes of

his recovery. In this way he continued, but ultimately sinking slowly, until he died on the 28th of February.

At the autopsy, the bladder was found thickened, its fibres interlacing, with small pouches between, in which were found two tiny fragments; otherwise, the mucous membrane was almost healthy. The prostate was enlarged, and formed a bar, or stop, at the neck of the bladder. The kidneys were larger than natural, imbedded in much fat. Structure much mottled, and studded in places with cavities about the size of peas, filled with thick yellowish matter. Cortical substance diminished in both, at some points very pale, at others, dark, as if congested. The right kidney showed these changes rather more marked than the left. No calculous matter found.

Two cases of Lithotrity in children, one in a boy (see Chapter X., pp. 208-9), the other in a girl. I do not know any example on record of Lithotrity in this country performed on a girl at a previous date, and have therefore briefly mentioned it. Mr. Fergusson and others have done it several times since.

CASE No. XVII.

SMALL CALCULUS IN A BOY: LITHOTRITY—CURE.

R. L., a boy, aged 10, was sent to me at University College Hospital, by my friend, Dr. Price Jones, of Kingston.

Admitted September 11, 1860.—His symptoms have been of about six weeks' duration; he has had some obstinate attacks of retention, followed by incontinence of urine. His sufferings were severe.

September 13. I passed a small lithotrite, the pattern represented at fig. 81, page 210, and finding a small stone, probably, about the size of an orange pip, I crushed at once freely.

September 19. He has passed débris freely, but has some cystitis: urine contains much muco-pus, and does not pass freely. To have hot hip baths.

September 24. Has passed one fragment larger than the rest, while in a bath, and is greatly relieved.

September 23. Quite well ; no pain ; water clear and freely passed.

September 27. Discharged cured.

CASE No. XVIII.

SMALL CALCULUS IN A GIRL: LITHOTRITY—CURE.

C. P., a girl, aged 9, was admitted under my care, at the Marylebone Infirmary, July, 1854.

She had symptoms of stone, and some attacks of retention, which it was necessary to relieve by means of the catheter.

July 15. Sounded her, and found a smallish stone, in a rather capacious bladder.

July 20. After dilating the urethra somewhat with a sponge tent, I introduced a full-sized lithotrite, and, after some trouble, owing to the capacity of the bladder, caught a small stone, about the size of a nut: this was efficiently crushed at one sitting.

July 22. Much débris passed: no bad symptoms; she has passed water involuntarily in the night.

August. She left soon after quite well: having acquired full power over her bladder, which was a little impaired for a few days only.

The two concluding cases are examples of the applicability of Lithotritry to patients who have wholly lost the power of passing urine by their natural efforts, and who consequently have depended for some time previous to the operation on the catheter for all relief to the bladder. It was, at no distant period, customary to regard this condition as contra-indicating Lithotritry. So far from its doing so, I believe it to be a special indication, other things being equal, for that operation; since the bladder and urethra are so accustomed to instrumental contact, that it is ex-

ceedingly rare (and I have now seen several cases), to meet with inflammation of the urethra or bladder, or with constitutional disturbance following a sitting, or with troubles from impacted fragments in these cases. There is no difficulty in washing out or otherwise removing the débris. (See Chapter XI., p. 237.) The first case was that of a man who was the subject of pure atony of the bladder *without* enlargement of the prostate: the second was of greater age, with the prostate largely hypertrophied: two distinct and typical examples of the condition described.

CASE No. XIX.

CALCULUS OF MEDIUM SIZE—POWER OF MICTURITION TOTALLY LOST FOR SEVERAL YEARS : LITHOTRITY—CURE.

P. B., aged 57, was admitted under my care at University College Hospital, June 30, 1860, with the following history.

Between 1845 and 1855 he had several attacks of "inflammation of the bladder," causing retention of urine, which had been frequently prolonged, requiring catheterism for a few days and much treatment. There had been no stricture of the urethra.

In 1856 he had another attack, and more severe. Since that, now four years, he had passed no water except by catheter, which he introduced himself, and on the average between six and ten times in the twenty-four hours.

During the last few months he has been subject to attacks of rather profuse bleeding, and to pains in the penis and bladder.

July 2. He has had rather copious hæmorrhage from the bladder to-day, although remaining quiet in the ward, and no instrumental interference beyond the passing of his gum catheter (a No. 9), as usual.

July 6. The bleeding having stopped on the 4th, I introduced a lithotrite and seized the stone, which was at least an inch in diameter, with the view of observing the effect on the bladder,

and if hæmorrhage was produced by the act. I therefore did not crush. No bleeding or uneasiness followed on the next two or three days.

July 10. I crushed the stone for the first time without difficulty; no chloroform was necessary; the stone was phosphatic.

July 13. Another sitting: there had been no bleeding.

July 19. Much débris has been removed by catheter, and washing out once or twice: a third sitting.

July 24. Crushed several small pieces, withdrawing a good deal of débris, by the flat-bladed lithotrite.

July 26. No irritation: the fifth sitting.

July 30. Much débris has been washed out. Sounded carefully with small flat-bladed lithotrite and found nothing.

August 4.—Discharged cured.

I saw him occasionally during a few months as outpatient. There were no remains of the old symptoms; his bladder was in the same condition of atony as before.

CASE No. XX.

RATHER LARGE PHOSPHATIC CALCULUS—NO POWER TO PASS WATER EXCEPT BY CATHETER: LITHOTRITY—CURE.

In January, 1863, I had the opportunity of seeing an elderly gentleman in consultation with Dr. Dieudonné, of Southampton Street, Strand. The patient had suffered severely for some years from frequent and painful wants to pass water. The prostate was much enlarged, he had lost the power of relieving the bladder by his own efforts, and used the catheter constantly in consequence, which is now necessary almost every hour. I sounded him, and we verified the existence of a stone of considerable magnitude.

Feb. 11. I seized the stone with a fenestrated instrument, and broke off some fragments; it is evidently a phosphatic formation, of rather hard consistence.

Feb. 16. No symptoms had followed the last sitting, and I repeated it to-day.

Feb. 19. Much débris has passed: patient improving: crushed again.

Feb. 23. The fourth sitting: this time by the lithotrite with plain blades.

Feb. 26. Much débris has come away: crushed with the same lithotrite.

March 1. Above four drachms of calculous matter have been removed altogether: no unpleasant symptoms have been occasioned: the patient has greatly improved, and it is agreed that Dr. Dieudonné, who sees the patient constantly, shall watch his opportunity, and crush any portions when it may seem desirable.

March 14. We sounded him carefully together, and found only a very minute fragment, which was crushed and removed.

March 21. Another careful sounding: nothing detected. Patient holds water now four hours, and has much improved in health.

A Table of 1827 cases of Lateral Lithotomy, being the entire experience, during given periods of time, of the following hospitals, metropolitan and provincial, referred to at pp. 225-230 of this work:—Guy's, St. Thomas's, University College, Norwich, Cambridge, Oxford, Birmingham, Leicester, and Leeds. This is for the purpose of exhibiting the prevalence of stone at different ages between the first and eighty-first year.

Age of Patient. Years.	Number of Patients.	Age of Patient. Years.	Number of Patients.
1 . . .	7	Brought forward .	850
2 . . .	74	12 . . .	58
3 . . .	116	13 . . .	32
4 . . .	153	14 . . .	35
5 . . .	123	15 . . .	26
6 . . .	90	16 . . .	27
7 . . .	86	17 . . .	18
8 . . .	49	18 . . .	26
9 . . .	57	19 . . .	19
10 . . .	60	20 . . .	13
11 . . .	35	21 . . .	12
Carried forward.	850	Carried forward .	1116

Age of Patient. Years.	Number of Patients.	Age of Patient. Years.	Number of Patients.
Brought forward .	1116	Brought forward .	1413
22 . . .	10	52 . . .	11
23 . . .	9	53 . . .	17
24 . . .	12	54 . . .	25
25 . . .	11	55 . . .	23
26 . . .	10	56 . . .	26
27 . . .	5	57 . . .	25
28 . . .	6	58 . . .	16
29 . . .	11	59 . . .	22
30 . . .	11	60 . . .	33
31 . . .	3	61 . . .	17
32 . . .	14	62 . . .	22
33 . . .	7	63 . . .	22
34 . . .	9	64 . . .	16
35 . . .	9	65 . . .	26
36 . . .	5	66 . . .	20
37 . . .	3	67 . . .	14
38 . . .	14	68 . . .	17
39 . . .	4	69 . . .	8
40 . . .	21	70 . . .	16
41 . . .	4	71 . . .	8
42 . . .	7	72 . . .	5
43 . . .	11	73 . . .	4
44 . . .	4	74 . . .	2
45 . . .	17	75 . . .	9
46 . . .	11	76 . . .	4
47 . . .	15	77 . . .	0
48 . . .	6	78 . . .	1
49 . . .	10	79 . . .	0
50 . . .	23	80 . . .	4
51 . . .	15	81 . . .	1
Carried forward .	1413	Total	1827

I N D E X.

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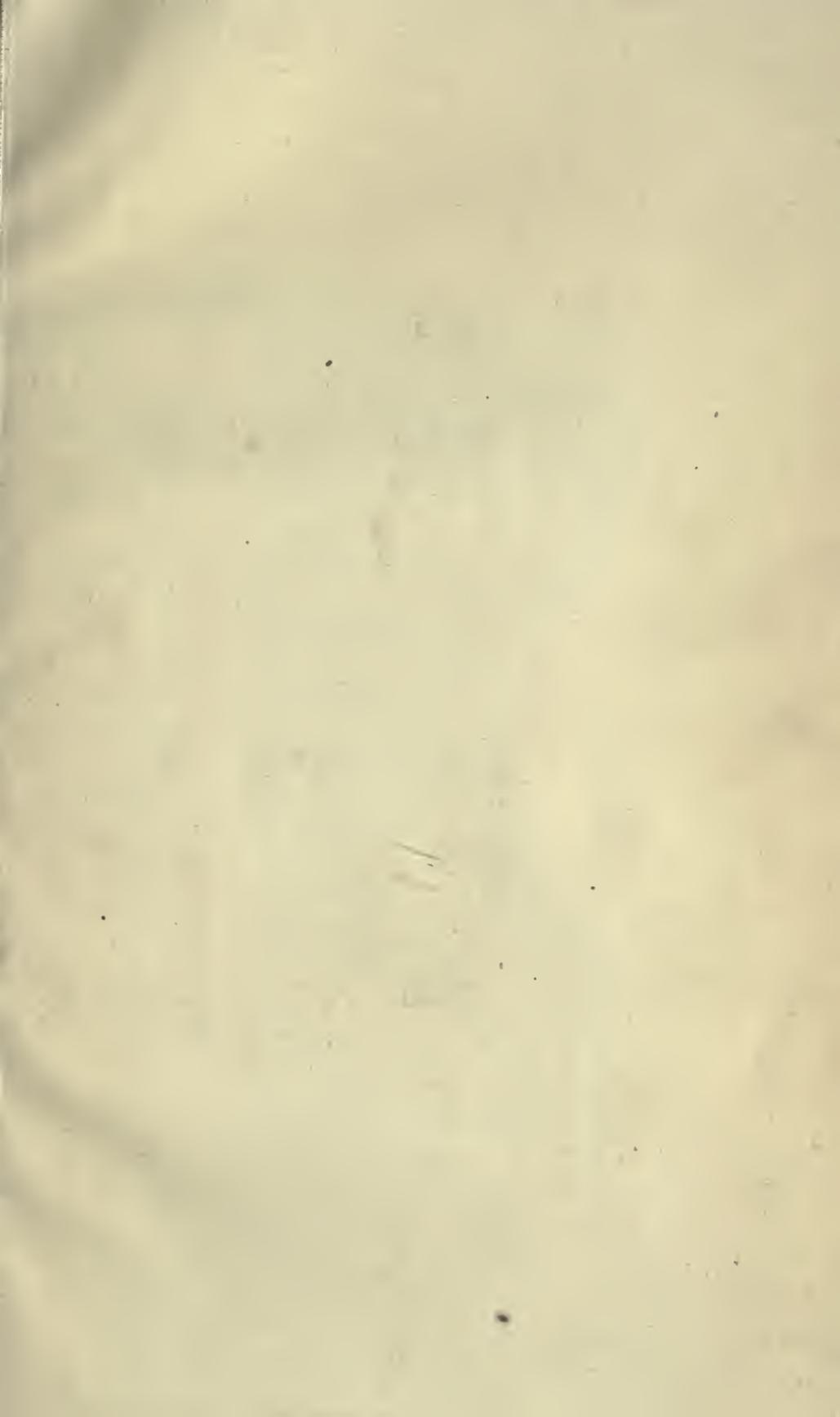
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